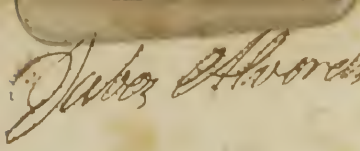

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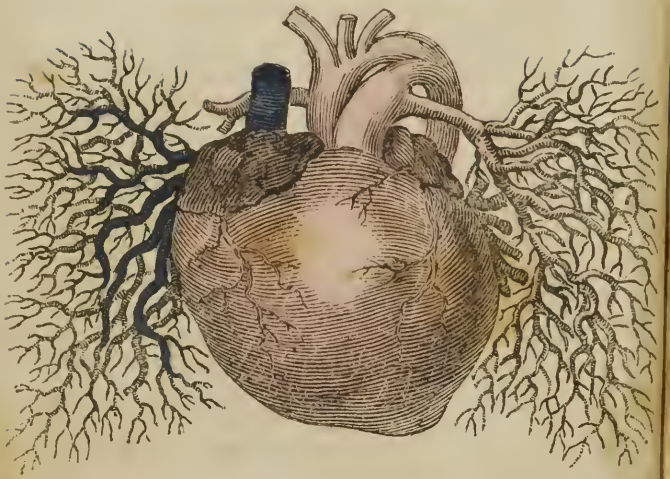

In
Wisdom we're form'd,
By
Goodness sustain'd.

AN

ANALYTICAL VIEW

OF

THE ANIMAL ECONOMY.

CALCULATED FOR

THE STUDENTS OF MEDICINE,

AS WELL AS

PRIVATE GENTLEMEN:

INTERSPERSED WITH

MANY ALLEGORIES, AND MORAL REFLECTIONS,

DRAWN FROM THE SUBJECT,

TO

AWAKEN THE MIND TO AN ELEVATED SENSE

OF THE

GREAT AUTHOR OF NATURE.

BY ISAAC BALL,

PHYSICIAN AND SURGEON, AND DIPLOMATIC MEMBER

OF THE MEDICAL SOCIETY OF THE CITY AND

COUNTY OF NEW-YORK.

Quum nobis denegatur diu vivere, aliquid relinquamus quod nos vixisse testetur.

Since it is denied us to live long, let us ~~do~~ leave something which may prove that we have lived.

THE SECOND EDITION, WITH LARGE ADDITIONS.

New-York:

PRINTED FOR THE AUTHOR,

BY SAMUEL WOOD.

.....

1808.

District of New-York. ss. BE IT REMEMBERED, That on the twenty-fifth day of January, in the thirty-second year of the Independence of the United States of America, ISAAC BALL, of the said district, hath deposited in this office, the title of a book, the right whereof he claims as proprietor, in the words following, to wit:

"An Analytical View of the Animal Economy. Calculated for the Students of Medicine, as well as private gentlemen: interspersed with many allegories and moral reflections, drawn from the subject, to awaken the mind to an elevated sense of the great Author of Nature. By ISAAC BALL, Physician and Surgeon, and Diplomatic member of the Medical Society of the City and County of New-York.

Quum nobis denegatur diu vivere, aliquid relinquamus quod nos vixisse testetur.

Since it is denied us to live long, let us leave something which may prove that we have lived."

In conformity to the Act of the Congress of the United States, entitled, "An Act for the encouragement of Learning, by securing the Copies of Maps, Charts, and Books, to the Authors and Proprietors of such Copies, during the times therein mentioned;" and also to an Act entitled, "An Act supplementary to an Act entitled An Act for the encouragement of Learning, by securing the Copies of Maps, Charts and Books, to the Authors and Proprietors of such Copies, during the times therein mentioned, and extending the benefits thereof to the arts of Designing, Engraving, and Etching Historical and other Prints."

EDWARD DUNSCOMB,
Clerk of the District of New-York.

TO

WRIGHT POST, ESQ.

PROFESSOR OF ANATOMY AND SURGERY

IN COLUMBIA COLLEGE,

AND ONE OF THE

SURGEONS OF THE NEW-YORK HOSPITAL,

THE PESENT VOLUME IS INSCRIBED;

IN testimony of the sensations of the high regard with which the writer is impressed, by the many invaluable professional services conferred by his friendship, on his

Very grateful and

Obedient Servant,

THE AUTHOR.

New-York, Oct. 10, 1808.

PREFACE
TO THE FIRST EDITION.

MY declining years and late ill state of health have, in a great measure, excluded me from those active medical pursuits in which I have been employed upwards of thirty years—and presume, with success and satisfaction, to my friends and fellow citizens.

My moments of leizure I determined to employ in writing the following pages: the subject, I trust, will not be considered as unworthy the attempt, nor unacceptable to my respectable readers—the language being adapted to the level of every capacity.

"Of all the diversions in life, there is none so pleasing to fill up its empty spaces, as the reading of useful and entertaining Authors:" an elegant writer thus expresses himself, 'a good book is a good companion,' and with that, the conversation of a well selected and intelligent friend.

I. B.

ILLUSTRATION.

THE FRONTISPIECE

Represents the Heart, and aborescent branches of the pulmonary arteries and veins, to supply those organs with the vital fluid.

THE VIGNETTE

Represents the Dawning of Life, under the figure of an infant, resting on a lyre, the seven strings of which are emblematical of the seven ages of man, "*whence life must downward tend.*" As the concordance of sounds produces harmony, so the harmony of the animal and vital functions, produces concordance, health, and longevity.

PRELIMINARY ADDRESS.

In this inquiring age, when a desire of knowledge has spread itself far and wide over this western hemisphere; when we sit not easy nor contented under the opinions of ancient times, but resolve to *examine for ourselves*, and judge from our *own experience*, it may not, perhaps, prove unacceptable to propose, as a subject for inquiry,

"*An Analytical View of the Animal Economy.*"

The works of nature are an inexhaustible source of true knowledge; and the study of them the most noble employment of a rational mind. Every part of the creation arrests our attention, and proclaims the power and wisdom of its Almighty Author.

The smallest seed, the minutest insect points to the skill and wisdom of the Creator, in the fitness of its constitution for the wise purposes designed, and displays an elegance of beauty beyond the reach of art.

The ancients, probably having only their eyes to trust to, were incapable of detecting those discoveries with which the microscope furnishes us. It presents us, as it were, a new sense of

vision: developes the amazing operations of nature, and affords new wonders to an admiring world!

Who, a thousand years since, would have imagined it possible to distinguish myriads of animals in a drop of water? Or that the crimson tide of life, and even the globules of that fluid, should be conducted, and seen distinctly, rolling through canals smaller than the finest hair?

That not only the exterior form, but even the structure of the intestinal tract, and the motions of the fluids in the smallest insect, should be rendered objects of sight!

These are noble discoveries, whereon a new phylosophy has been erected. This enlarges the capacity of the soul, and furnishes a more just and sublime idea than mankind before had, of the grandeur and magnificence of nature, and of the infinite power, wisdom, and goodness of nature's God.

That man is certainly happy, who is capable of discovering the greatest number of rational and useful inventions, or amusements, easily attainable, and within his power: if so, he that is delighted with the works of nature, and makes them his study, must, we presume, be happy; since every animal, flower, fruit and insect affords him new pleasures; and he considers the whole universe a magazine of won-

ders, which ages are scarcely sufficient to contemplate and admire!

The invention of glasses has brought into view the two extremes of creation; which were probably beyond the inspection of former ages; those vast and distant bodies of the solar system, whose dimensions, distances, motions, regularity and order we are become acquainted with by the help of the telescope; and we owe the knowledge of those extremely minute species of animals, plants, &c. to the microscope.*

Mr. Boyle says, his wonder dwells not so much on nature's *clocks*, as on her *watches*. If we compare the structure of a mite with that of an elephant, we shall be led to this opinion.

The massy matter and surprising strength of the one may astonish us, but we shall find ourselves lost in amazement if we attentively examine the several minute parts of the other. For the mite has more limbs than the elephant; each of which is furnished with veins and arteries, nerves, muscles, tendons and bones. It

* The invention of the telescope is ascribed to JANSON, a Dutchman, who flourished in 1590. The English have improved this instrument to a degree of perfection most astonishing. The construction of the microscope, resulting from the same principles, was invented in Naples, in the year 1621.

has eyes, a mouth and a proboscis, to take in its food; it has a stomach to digest it, and intestines to carry off what is not retained for nutrition. It has a heart, to propel the circulation of the vital fluid, and a brain to supply nerves every where. Let us stop, ponder, wonder and admire, as far as our feeble abilities can reach, the extreme minuteness of all these parts!

We shall now proceed on our plan, and modestly endeavour to present our respected readers with a brief view of our subject, which it is hoped may afford some interest and amusement.

AN

ANALYTICAL VIEW

OF

THE ANIMAL ECONOMY.

Dawning of Life.

"When life is new the ductile fibres feel
The heart's increasing force, and, day by day,
The growth advances, till the larger tubes,
Acquiring (from their elemental veins,
Condensed to solid chords) a firmer tone,
Sustain, and just sustain—the impetuous blood:
Here stops the growth. With overbearing pulse,
And pressure, still the great destroy the small,

Still with the ruins of the small grow strong:
Life grows, mean time, amid the grinding force
Of viscous fluids, and elastic tubes;
In various functions vigorously are plied,
By strong machinery, and in solid health
The man confirmed, long triumphs o'er disease:
But the full ocean ebbs; there is a point,
By nature fix'd, *whence life must downward tend;*
For still the beating tide consolidates
The stubborn vessels, more reluctant still
To the weak throbs of the ill supported heart;
These languishing, these strengthening by degrees,
To hard, unyielding, unelastic bone,
Through various channels the congealing flood
Crawls lazily, and hardly wanders on:
It loiters still—and now it stirs no more.—
This is the period few attain: the death
Of nature: thus (so Heaven ordain'd it) life
Destroys itself: and could these laws have chang'd,
Nestor might now the fate of Troy relate,
And Homer live, immortal as his song."

It is said that in a new-born infant the pulse vibrates about 134 strokes in a minute: in middle age, from 60 to 80; and in extreme old age, from 50 to 24.

RESPECTFULLY ADDRESSED

TO OUR

FAIR READERS.

"CONNUBIAL fair! whom no fond transport warms
To lull your infant in maternal arms;
Who, bless'd in vain with tumid bosom, hear
His tender wailing with unfeeling ear;
The soothing kiss and milky rill deny
To the sweet pouting lip, and glist'ning eye!
Ah! what avail the cradle's damask roof,
The downy bolster, and embroidered woof?
Oft hears the gilded couch unpity'd 'plains,
And many a tear the tassel'd cushion stains!
No voice so sweet attunes his cares to rest,
So soft no pillow as his *mother's breast!*

Nature not only points out the food proper for infancy, but also kindly prepares it. When the little inhabitant is ushered into this cold world, if applied to the maternal bosom, its sense of perceiving warmth, is first agreeably affected: next, its sense of smell is delighted with the fragrance of the dulcid rill: then, its taste is gratified by the

flavour of it: afterward, the appetite of hunger and thirst afford pleasure, by the possession of their objects, and by the subsequent health of the infant; and lastly, the sense of touch is delighted by the softness of the lactary fountain, which the innocent embraces with its hands, presses with its lips, and watches with uplifted eyes. Satisfied, it smiles at the enjoyment of such a variety of rich pleasures. It feels an animal attraction, which is love: a sensation when the object is present, a desire when it is absent; which constitute the purest source of human felicity.

It is calculated that of one thousand infants nursed by the mother, not above 300 die; but of the same number nursed by others, 500 perish!

Address

TO

STUDENTS IN MEDICINE.

GENTLEMEN,

I offer these sheets to you as being the basis of lectures of the most eminent anatomists, and as containing a brief view of the varied departments of the animal body.

From a desire of being useful in my profession, I have ventured to present this compilation for your perusal, and have no doubt of your favourable acceptance of it, nor of your candid interpretation of my views.

Should you propose to pursue your researches in anatomy, (the basis of medical science) in attending the school established at Columbia College, or elsewhere, by making observations, and taking notes of extraordinary morbid appearances in the cadaverous subject, and by proposing them occasionally as the subjects of your reflection, you will derive great and per-

manent advantages: from such rational experience you may expect to acquire a degree of confidence in yourselves, and will be animated to proceed in your honourable pursuits, with proper resolution.

Pursue then, with zeal and perseverance, the steps that lead you to knowledge, and an elevated understanding in your profession; and support the credit and dignity of medical science, with honour to yourselves and your country.

The youth who, led by *Wisdom's* guiding hand,
Seeks *Virtue's* temple, and her law reveres,
He, he alone in *Honour's* dome shall stand,
Crown'd with rewards, and rais'd above his peers.
Recording annals shall preserve his name,
And give his virtues to immortal *fame*.

With sincere wishes for your success and happiness in life, and with sentiments of earnest solicitude for your interest and advancement in our honourable profession,

I remain,

Gentlemen,

your affectionate friend,

ISAAC BALL.

Anatomy.

Anatomy is a science which explains the structure and use of every part of the human body.

The examination of brute animals, fishes, reptiles, plants, polypi, &c. in order to illustrate more clearly, or to demonstrate by analogy, the structure and functions of man, is called comparative anatomy.

Anatomy is divided into nine parts, viz.

Osteology,	Or doctrine of the	Bones.
Syndesmology,		Ligaments.
Myology,		Muscles.
Bursalogy,		Bursæ Muscoæ.
Angiology,		Vessels.
Neurology,		Nerves.
Adenology,		Glands.
Splanchnology,		Viscera.
Hygrology,		Fluids.

Plan

OF THE NOBLE EDIFICE.

Bones of the Head.

- Bones of the Cranium, or Skull.
  - Os Frontis . . . 1
  - Ossa Parietalia . . 2
  - Os Occipitis . . . 1
  - Ossa Temporalia . 2
  - Os Ethmoides . . 1
  - Sphacnoides . . . 1
- Bones of the Face.
  - Ossa Maxillaria sup. 2
  - —— Jugalia . . . 2
  - —— Nassalia . . 2
  - —— Lachrymalia . 2
  - —— Palatina . . 2
  - —— Spongiosa infer. 2
- Dentes, or Teeth.
  - Os vomer 1
  - — Maxillare infer . 1
  - Incisores 8
  - Cuspidati 8
  - Bicuspides . . . 4
  - Molares 8
  - Sapientiæ 4
- Bone of the Tongue, or Os Hyoides 1
- Bones of the internal Ear, situated within the Temporal bone.
  - Malleus 2
  - Incus 2
  - Stapes 2
  - Os Orbiculare . . 2

63

Brought over 63

Bones of the Trunk.

- Spine.
  - Vertebræ
    - Cervical 7
    - Dorsal 12
    - Lumbar 5
  - Sacrum 1
  - Os Coccygis . . 1
- Thorax.
  - Sternum. . . . 1
  - Ribs 24
- Pelvis.
  - Ossa Innominata . 2

Bones of the Upper Extremities.

- Shoulder.
  - Clavicula . . . 2
  - Scapula 2
- Arm.
  - Os Humeri . . . 2
- Fore-arm.
  - Ulna 2
  - Radius 2
- Hand.
  - Carpus, or Wrist.
    - Os Naviculare 2
    - — Lunare . 2
    - — Cuneiforme 2
    - — Orbiculare 2
    - — Trapezium 2
    - — Trapezoides 2
    - — Magnum . 2
    - — Unciforme . 2
  - Metacarpus 10
  - Phalanges 28

180

Brought over				180
Bones of the Lower Extremities.	Thigh.		Os Femoris	2
	Leg.		Patella	2
			Tibia	2
			Fibula	2
	Foot.	Tarsus.	Os Calcis	2
			— Astragalus	2
			— Cuboides	2
			— Naviculare	2
			— Cuneiformia	6
		Metatarsus		10
		Phalanges		28
				240
Sesamoid bones of the thumb and Great Toe, occasionally found				8
			Total,	248

The Egyptians, at their feasts, to prevent excesses, presented a

Skeleton

before their guests, with this motto:

"Remember ye must
Be shortly thus."

Elevation.

Let us begin with the less adorned, but more solid parts which support and defend the rest.

First, we have a system of bones, made in a variety of shapes, in a variety of sizes: all strong, that they may bear up the machine, yet light, that they may not weigh us down; hollowed with an inward cavity to contain the moistening marrow, and perforated with fine ducts, to admit the nourishing vessels.

They are larger at their extremities—and insensible—that they may be joined more firmly, and not be hurt by pressure.

The manner of their articulation is truly admirable and remarkably various, yet never varied without demonstrating some wise design, and answering some valuable end.

Frequently, when two bones are united, the one is nicely rounded and capped with a smooth substance, the other is scooped

into a hollow of the same dimensions to receive it, and both are lubricated with an unctuous fluid to obviate the evil of friction, and to facilitate rotation.

These are connected by ligaments, a tough and strong arrangement of fibres, which render what would otherwise be an elegant, yet useless assemblage of parts, a well compacted and manageable system.

The feet compose the finest pedestal, infinitely beyond all that statuary can accomplish, capable of altering its form, and extending its size, as different circumstances require.

The undermost part of the heel, and the extremity of the sole, are shod with a tough insensible substance ; a kind of natural sandal which never wears out, never wants repair, and which prevents an undue compression of the vessels by the weight of the body.

The legs and thighs are like stately columns, so articulated that they are commodious for walking, and yet adapted to the easy posture of sitting.

The ribs, turned into a regular arch, are gently moveable for the act of respiration, they form a safe lodgment for the lungs and heart, the two most important organs of life.

The back bone is designed not only to strengthen the body, but to shield the continuation of brain, usually termed the spinal marrow, which is almost an infinite assemblage of nerves !

By commodious outlets, it trasmits these silver cords, to different parts of the body.

Had it been a single bone, the loins must have been inflexible, to avoid which, it consists of a number of small bones which articulate together, and are strengthened by compact ligaments.

By this means, it is capable of various inflections, without injuring the cords of life, or diminishing that strength which is so much required here.

This peculiarity of structure gives the back bone the pliancy of the osier, with the firmness of the oak ; such a formation in any other of the solids must have oc-

casioned great inconvenience, here it is unspeakably useful; a master piece of creating skill.

The arms are exactly proportioned to each other, to preserve the equilibrium of the structure.

These being the guards to defend, and the ministers that serve the whole body, are fitted for the most diversified and extensive operations, firm with bone, yet not weighty with flesh, and capable of performing all useful motions; they bend inward, and move outward, they move upward or downward, they wheel about in whatever direction we please.

To these are added hands, terminated by the fingers, not of the same length, nor of equal bigness, but in both respects different, which give more beauty and far greater usefulness.

Were they all flesh; they would be weak; were they one entire bone, they would be utterly inflexible, but consisting of various little bones and muscles, what shape can they not assume?

Being placed at the end of the arm, the sphere of their actions is exceedingly enlarged.

Their extremities are an assemblage of the finest nerves, acutely sensible, which notwithstanding, are destined to almost incessant employ, and frequently among rugged objects.

For this reason, they are overlaid with nails, which preserve them from any violent injury.

The hand is the original and universal sceptre, which not only represents, but ascertains our dominion over all the elements, and over every creature.

To these hands, we owe the most beautiful statues, the most melodious instruments of music.

By the strength of the hand, the tallest firs fall, and the largest oak descends from the mountain.

Fashioned by the hand, they become a floating warehouse, and carry the productions of art from America, and unfurl the

spreading canvass to the breeze, in the remotest corner of the universe.*

* The first navigators, builders of ships, and merchant adventurers, to all the then known parts of the world, were the Phœnicians, who inhabited near the sea side: but their invention extended no farther than to open vessels, which afterwards had great improvements; for the Egyptians made ships with decks; and galleys with two banks of oars at a side. Ships of burden and stowage were first made by the Cypriots: smacks, hoys, cockboats, and skiffs, by the Liburnians: brigantines, by the Rhodians; and vessels of war, by the Pamphilians. The Boetians invented oars: Dedalus, of Crete, masts and sails: the Tuscans, anchors: the rudder, helm, and the art of steering were found out by Typhis, who took his hint from seeing a kite in flying, guide her whole body by her tail, or rudder.

Several centuries before the christian era, according to the page of history, a person, of the name of Magnes, walking over a stone mine, with nails in his shoes, found his feet strongly attracted to the surface. This singular circumstance occasioned the discovery of the common magnet, or load stone; which received its name from the person who had been first sensible of its power. But the honour of discovering the directive power which the magnet gives to the needle of a compass, was reserved for John Goya, a Neapolitan, who flourished in 1300. Since that time, the mariners compass has received every improvement which its importance could suggest, or philosophy and experiment divine. What a grand, what a noble, what a sublime scene is, by this *little director*, displayed!

Invention is the mark of a fruitful genius; and when beneficial to mankind, it gives the author an honourable

Though we have not the strength of the horse, nor the swiftness of the greyhound, nor the quick scent of the spaniel, yet, directed by the understanding and enabled by the hand, we can, as it were, make them all our own.

These short hands have found a way to penetrate the bowels of the earth.

These feeble hands can manage the wings of the wind, arm themselves with the violence of thunder, and press into their service the forcible impetuosity of water !*

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commemoration to perpetuity. Next to inventions, those that have improved them to greater perfection than was originally discovered, have also claims to public gratitude, with the first authors.

*COLUMBIAN YOUTH ! we call your attention to the manes of the illustrious FRANKLIN ! who, emanating from the walks of humble life, imbittered with the conflicts of outrageous fortune, *PERSEVERED* until he attained to that elevation in science, society, and virtue, which distinguished him for the statesman, philosopher, and philanthropist He died at an honourable old age, at Philadelphia, April 17, 1790.

An elegant writer is of opinion, " that the Author of nature has thought fit to mingle, from time to time, among the societies of men, a few, and but a few, of those to whom he is graciously pleased to bestow a larger propor-

How greatly then, are we indebted to our infinitely wise Creator, for distinguishing this invaluable member!

Above all is the head, for the residence of the brain, rounded to receive, and firm to defend it.*

This is screened from heat, defended from cold, and at the same time beautified by the hair; a decoration so elegant, that no art can supply; so perfectly light as in no way to encumber the wearer.

While other animals are prone in their aspect, the attitude of man is erect, which is by far the most commodious for the pro-

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tion of the ethereal spirit, than is given in the ordinary course of his providence to the sons of men."

* Here our contemplation is arrested, to wonder and admire the workmanship of creating skill! To perform the varied offices assigned the head, which rests immediately upon the uppermost joint, or vertebra of the neck, and is united to it by a *hinge joint*, upon which the head acts freely forward and backward, as may be necessary. The next joint below permits the rotary motion; and this mechanism resembles a *tenon* and *mortise*. We see the same principle employed in the frame, or mounting of the telescope. This occasionally requires that the object end of the instrument be moved up and down, as well as horizontally, or equatorially.

secution of all his extensive designs—does it not remind us of our noble original, and our sublime end?

Struck with the grandeur of the subject, we would fain set forth all its beauties, but our pencil, which is too faint, cannot correspond with the vivacity of the countenance; how, indeed, can any one describe with energy, these admirable proportions; these features, full of force and dignity, expressing to all beholders the tender emotions and passions as they arise in the heart; this open and elevated brow, these lively and piercing eyes, eloquent interpreters of the sentiments of the soul; this mouth, the seat of smiles; these ears, whose delicacy catches even the softest whispers!

If you take a still further survey of this beautiful edifice, the prodigious number of its parts, their surprising diversity, admirable construction, wonderful harmony, and infinite art, displayed in the distribution of them, it will throw us into such an ecstasy, that we shall no sooner recover from it, than complain of our want of suf-

ficient inclination and ability to admire such marvellous excellency.

Here are arteries, the rivers of our little world, that striking out as they go into numberless small canals, visit every street, yea every apartment in the vital city.

They are not like several of the veins near the surface, but placed at a sufficient depth, and thereby are more secure from external injuries.

The arteries also commence by collateral branches with each other, so that if any thing block up or straiten the direct passage, the current by directing to this new channel, eludes the impediment, flows on, and soon regains its wonted course.

The blood thrown from the heart dilates instantly the arteries, whose fibres by their irritability or elastic power re-act on the blood, by which means, as they propel it onward, they vibrate against the finger, and much assist the physician in the discovery and cure of diseases.

The extreme branches of arteries terminate in veins, which may be considered

as uniting again into larger branches, then again into branches still larger, and so on continually, till at last they form one large pipe or trunk, which re-conveys the blood to the heart.

The arteries are composed of several principal membranes placed on each other, one of these is highly elastic.

The veins not being designed to exercise the same function as the arteries, want this elastic coat; and the texture of them altogether is considerably slighter: such an exact economist is nature, amidst all her liberalities!

At the root of the arteries, and in the inner part of the veins, are placed little sluices or valves, which by sinking and raising again, open and shut the canal.

These are found only when the blood is constrained to climb, for where the ascent ceases, they cease also.

In the centre of the breast, between two spungy masses, known by the name of the lungs, is deposited a fleshy and hollow py-

ramid, called the heart. This pyramid has an apex or point, turned towards the left side, and is the main spring of the animated machine.

The ramifications of the bronchiæ or windpipe, which are dispersed throughout the lungs, carry thither the vivifying air, which by acting on the spongy mass opens, dilates, and extends them, and by that means facilitates the course of blood.*

Such indeed are the admirable organs destined for the circulation of the blood; but how greatly does this imperfect sketch fall short of the reality! How incapable are the outlines of expressing the beauties of this noble subject!

* The infinitely wise Creator of our bodies, has placed lymphatic glands, as sentinels, to interrupt whatever is inimical to our health; which, without such a guard, would be daily, even hourly liable to be injured, not only by putrid and offensive matter floating in the atmosphere, but even what is sweet and delicious might have this pernicious effect: we might literally "*die of a rose, in aromatic pain*"

Dr. Nieuentryt, in the *Leipsic Transactions*, reckons up an hundred muscles that are employed every time we breathe.

There is, in the consideration of the organs performing the circulation of the blood, an air of grandeur that seizes forcibly on the mind, and penetrates it with the highest admiration!

Far less magnificent in its plans, less skilful in the execution of them, hydraulics offer us but faint images of this miracle, in those machines, by means of which, water is distributed into every part of a great city.

The works of the Creator must be compared to the emanations of the same infinite mind: ever like himself, he has impressed on all his productions a character of nobleness and excellence, which demonstrate their divine original.

But what are those excellent discoveries philosophy has made, compared with the beauties that are still concealed from our view! The gloom of night veils many important truths concerning the animal body, and *you* are desirous of chasing them away.

May the dawn of that day, ere long gild the horizon of this Western World! And may the time of its breaking forth upon us be not afar off!

The glands are an assemblage of tortuous vessels, complicated with seeming confusion, yet perfectly regular.

We cannot as yet penetrate into the mystery of secretion, all that we know is, that those fluids said to be secerned, are not absolutely contained within the blood, any more than the peach, nectarine, or other fruits, are principles filtered from the earth and water, which nourish the tree.

Nevertheless, as the seven notes of music differently combined, and the twenty-four letters, form the whole of harmony and language, so may all those fluids arise from the change of combinations of primitive parts, by a machinery that no chymist can ever perfectly imitate.

We have nerves, which shoot out their fibres from the brain, and when remote from their source, are surprisingly minute; which set the muscles to work at the command of the will, and diffuse sensation throughout the body; and upon any impression without, give all needful intelligence to the soul.

We have membranes, thin and flexible coverings, to inwrap the fleshy parts, to connect some, and form a separation between others.

We have muscles, composed of the finest fibres, yet endowed with incredible strength, fashioned after a variety of patterns, but all in the highest taste for elegance and use.—These execute their functions as quick as lightning. Were we to remove mountains, we could not be more astonished, than that this arm, these fingers should obey the order of the will.

To turn the screw, or work the lever, is laborious and wearisome; but we work the vertebræ of the neck, with all the appendant parts; we advance the leg with all the incumbent body; we rise, we spring from the ground, and though so great a weight is raised, we meet with no difficulty or fatigue.

That all this should be effected without any toil, by a bare act of the will, is very surprising: but that it should be done even while we are entirely ignorant of the man-

ner in which it is performed, is most astonishing!

We have fat, an unctuous fluid, contained in vesicles, which have the appearance, if viewed through a microscope, of a cluster of grapes.

This flanks and fortifies our muscles, like a strong bastion, supports and warms them, like a soft pillow. It fills up the vacuities, and smooths the irregularities of the flesh; inwardly, it supplies the machine for motion; outwardly, it renders it smooth and graceful.

The skin is a curious *surtout*, which covers the whole, formed of the most delicate net-work, whose meshes are minute, and whose threads are multiplied even to a prodigy; the meshes are so minute, that nothing discernible by the eye passes through them, though they discharge, every moment, myriads and myriads of superfluous encumbrances.*

* The perspirable fluid is supposed to embrace two parts fixed air, and one part azotic air and water, impregnated with different saline matter.

These threads are so multiplied, that neither the point of the most delicate needle, nor the infinitely finer lance of a gnat, can pierce any part, without drawing blood, and causing an uneasy sensation; consequently wounding, by so small a puncture, both a nerve and a vein.

But a course of incessant action must exhaust the solids, and waste the fluids: and, unless both be properly recruited, the machine would be destroyed.

For this reason, our bodies are furnished with the organs, and endowed with the power of nutrition.

We have teeth, tests of heat and cold; the foremost thin and sharp, to bite asunder the food; the side teeth for the purpose of tearing, and the hindermost broad and strong, indented with small cavities, the better to grind into pieces what is committed to them.

Were the teeth, like other bones, covered with the periosteum, chewing would give much pain; were they quite naked,

they would soon decay and perish: to guard against both, they are covered with a neat enamel, harder than the bone itself, which gives no pain in chewing, and yet secures them from various injuries.

The lips prevent the food from slipping out of the mouth, and, assisted by the tongue, return it to the grinders.

While they do this in concert with the cheeks, they squeeze out a thin liquor from the adjacent glands, which moistens the food, and prepares it for digestion.

When the mouth is inactive, these glands are nearly closed; but when we speak or eat, their moisture being then necessary, is expressed as need requires.

But the food could not descend merely by its own weight, through a narrow and clammy passage, into the stomach.

Therefore, to effect this, fibres, both straight and circular, are provided; the former enlarge the cavity and give an easy admittance; the latter, closing behind the descending aliment, press it downward.

But before the food enters the gullet, it must of necessity pass over the orifice of the windpipe, whence it is in danger of falling upon the lungs, which might endanger immediate suffocation.

To obviate this, a moveable lid, or sentinel is placed, which, when the smallest particle advances, is pulled down and shut close, but as soon as it is swallowed, is again let loose and stands open.

Thus the important pass is always made sure against any noxious approaches, yet left free for the admission of air, and for respiration.

The food, descending into the stomach, is not yet ready for the bowels; therefore, that great reservoir is strong to bear, and fitted to retain it, till it is properly wrought into the smoothest pulp, by the power of the gastric juice, a fluid secreted in the stomach itself.

From hence it is discharged by a gentle force, and passes gradually into the intestines.

Near the entrance of this canal, are the ducts of the pancreas and gall-bladder, which are stimulated by the chyle.*

The pancreas is connected with the spleen, which as the stomach becomes filled, is pressed by it, and in consequence, pours into this gland a greater quantity of blood, to be changed into pancreatic juice.

The gall-bladder is attached to the liver, and is the reservoir to retain the bile, which pierces the intestines, and blends the oil and aqueous parts into one homogeneous mass.

It is furnished with a valve, of a very peculiar nature; namely, of a spiral form, through which the detersive liquid can only gently ooze. Admirable construction! which gives the needful supply, as occasion may require, and no more!

The nutriment then pursues its way through the mazes of the intestines.

* This term is used to express the aliment, when dissolved in the stomach.

Had these been straight or short, the food could not have resigned a sufficient quantity of its nourishing particles; therefore they are artfully convolved, and filled with numberless folds or plaits, and of great length.*

Along the sides of the winding passage, countless multitudes of minute vessels protrude themselves, and absorb the nutritious juices.

As the aliment proceeds, it is more and more drained of its nutritious juices. Glands are, therefore, posted in the proper places to discharge a lubricating fluid;

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* The length of this canal varies in carniverous and herbiverous animals. The shortest, we believe to be in some birds of prey, in which the intestinal tube is little more than a straight line, from the mouth to the exit. The longest is in the deer kind. The intestines of a Canadian stag, four feet high, measured ninety-six feet.† The same volumn in a sheep, unravelled, measured thirty times the length of the body: that of a cat, only thrice the length of the body. Universally, where the substance upon which the animal feeds, is of slow concoction, or yields its chyle with more difficulty, there the passage is circuitous and dilatory, that time and space may be allowed for the change and absorption, which are necessary to life.

† *Mem. Acad. Paris*, 1701, *page* 171.

these are smaller, or fewer, in and near the stomach, because there the aliment is moist enough; whereas, in the bowels, remote from the stomach, they are either multiplied or enlarged.

The chyle drawn off by the lacteals is carried through millions of tubes, whose perforations are too fine, even for the microscope to discover. To this it is owing, that nothing enters the blood but what is capable of passing the finest vessels.

It is then lodged in several commodious cells, the glands of the mesentery, and there mixed with a thin diluting lymph, which makes it more apt to flow.

Here it is conveyed to the common receptacle, and mounts through a perpendicular tube to be poured into the left subclavian vein; there it mixes with the blood and loses the name of chyle.

From this vein, the new blood passes into the upper branch of the principal trunk of veins, which carries it towards the heart.

It then passes into the right auricle of the heart, which opens at its approach, and by closing immediately, forces it into the right ventricle, which is dilated to receive it.

The ventricle instantly contracts itself, (the valve with which it is furnished, raising itself to oppose the reflux into the auricle) and the blood is compelled to pass into the great artery, which is appointed to carry it to the lungs.

The pulmonary artery, which is subdivided into two trunks, which pass to the right and left lobes, composing the lungs, (its valve preventing the reflux into the heart) by contracting, drives the blood into every part of those organs.

In the spongy cells of this amazing laboratory, the blood imbibes the oxygen portion of the external air, and assumes, in consequence, a more brilliant colour.

Thus improved, it enters the left auricle of the heart by the four pulmonary veins, and, in proportion to the oxygen air contained within the blood, the left auricle of

the heart, obedient to the stimulus, contracts and forces it into the left ventricle.

The latter, by contracting itself, pushes the blood into the aorta, which, by continually dividing and subdividing itself, distributes its balsamic liquor to all parts of the body, in order to promote their support or growth, occasion different secretions, and distribute the animal heat.

By this astonishing mechanism and dependance of the vital principle in the air, the powerful energy of the heart, seconded by that of the arteries, transmits the blood to the most remote parts of the body, notwithstanding the resistance which gravity, friction, and many other circumstances make to it in its course.

The large muscles of the arm, and of the thigh, are soon wearied; a day's labour or a day's journey exhausts their strength; but the heart toils whole weeks, whole months; nay, years, unwearied; is equally a stranger to intermission and fatigue.

The heart, receiving the distending and stimulating power of the blood, contracts

on it, and in one minute, such is its amazing force, it propels, says Baron Haller, fifty-one pounds of blood, through tubes of different dimensions, which if measured would extend beyond 149 feet. In a healthy person, it contracts not much less than 5000 times in an hour, perpetually in the same order, and never with fatigue.

The pulse arises from the dilatations, and contractions of the arteries, which, in some measure, correspond with those of the heart.

Impelled by the aorta, (for its valves prevent the reflux into the heart) part of the blood shoots upwards to the head; part rolls through the whole body; but how shall a stream divided into myriads of channels, be brought back to its source?

For this purpose, the all wise Creator has connected the extremities of all the arteries with the beginning of the veins; so that the same force which darts the blood through the former, helps to drive it through the latter.

The blood entering the right auricle, by the two opposite currents of the vena cava superior and inferior, that the streams may not clash, a fibrous excrescence interposes, which, like a projecting pier, breaks the stroke of each, and throws both into their proper receptacle.

Thus is the blood re-conducted to the great cistern, and thence played off afresh, first through the lungs, and then throughout the body.

We see, then, even from this imperfect survey, that man is a very complex machine.

In it, there is a peculiarity which claims particular notice; a power which defies all human ingenuity and imitation, and distinguishes the natural from the artificial machine.

As our bodies are composed of flexible materials, whereby they are liable to receive injuries by too rude a shock from harder bodies, and as the humours are also subject to receive alterations from changes of weather, irregularities in diet, and

other accidents, it was needful that the body, besides the power necessary for its performing all the functions requisite in a healthy state, should be provided also with other powers, whereby hurts and deviations from a healthy condition, might be amended and restored.

Were there not such a power in the body, we could scarcely arrive at full age, in any other than a disfigured condition, and the loss of the due action of many parts.

But our Creator has kindly provided, that the body, upon any wound received, should supply a cement, whereby the divided parts are again re-united, or throw out granulations, by which the breach is healed up. Thus, a broken bone is made firm again by a callus; a dead part is separated and thrown off; noxious juices are driven out by some of the emunctories; a redundancy is removed by some spontaneous discharge; a bleeding naturally stops of itself; and a great loss of blood from any cause, is, in some measure, compensated by a contracting power in the vascular sys-

tem, which accommodates the capacity of the vessels, to the quantity contained.

Thus, the stomach gives information when the supplies have been expended; represents with great exactness, the quantity, and the quality of what is wanted in the present state of the machine; and, in proportion as she meets with neglect, rises in her demand, urges her petition with a louder voice, and with more forcible arguments; and for its protection, the animal body is made capable of resisting heat and cold in a wonderful manner, and of preserving an equal temperature in a burning, and in a freezing atmosphere.

There is a still further excellence or superiority in the natural machine, still more astonishing, still more incomprehensible; namely, a power to perpetuate, as well as to preserve itself.

A dead statue, a painted shadow on a canvass, or, perhaps, a little brazen clockwork, is the supreme pride of the art of man—his highest excellence and boast.

On the other hand, how glorious and skilful an artificer would he be called, could he but make two of these pieces of clockwork, and so contrive the hidden springs and motions within them, that they should perpetuate their kind, and thus continue the same sort of clocks, in more than a thousand successions, down to the present day.

Such is the workmanship of GOD! Such the amazing power of his will! Such the long reach of his foresight, who has long ago guarded against all possible deficiencies; who has provided energy in nature, sufficient to replenish the world with plants and animals to the end of time, by the wondrous contrivance of his creation, and the laws he then ordained.

Not all the united powers of human nature, nor a council of the nicest artificers, with all their ingenuity and skill, can ever form a simple feather or a tulip: yet man can produce a man—admirable effect, yet artless cause! a poor limited inferior agent;

the plant and the brute, in this matter, are his rivals and his equals too.

The human parent, and the parent bird, form their own images with equal skill, but are confined by a kind of divine patent, each to his own work: so the iron seal transfers its own figure to the wax, with as much exactness and curiosity as the golden one; either can only transfer its own figure.

Perhaps there is not a lily, nor a butterfly in the world, but has gone through 6000 ancestors, and yet the work of the last parent is exquisitely perfect in shape, in colour, and in every perfection a beauty, but it is all owing to the first cause.

"Who can know and consider," says the celebrated Dr. Hunter, "the thousand evident proofs of the astonishing art of the Creator, in forming and sustaining an animal body such as ours, without feeling the most pleasing enthusiasm?" Can we seriously reflect on this awful subject, without being almost lost in adoration? without longing for another life, after this, in

which we may be gratified with the highest enjoyment, which our faculties and nature seem capable of, the seeing and comprehending the whole plan of the Creator, in forming the animal body, and in directing all its operations? The man who is really an anatomist, yet does not see and feel what we have endeavoured to express in words, whatever he may be, in other respects, must certainly labour under a dead palsy, in one part of his mind.

Milton could look upon the sun at noonday without seeing light; but the nerves of that organ were insensible.

But, further, the great Creator has made us an invaluable present of the senses, to be the inlets of innumerable pleasures, and the means of the most invaluable advantages.

The eye, in its elevated station, commands the most enlarged prospects.

Consisting only of gelatinous fluids, enclosed within coats, it shews us all the graces and glories of nature.

How wonderful, that an image of the hugest and widest landscape, should enter the small pupil! that the rays of light should paint on the optic nerve—paint in an instant of time—paint in the truest colours, and exactest lineaments, every species of external objects.

The eye is so tender, that the slightest touch might injure the delicate frame.

It is guarded, therefore, with peculiar care, intrenched deep, and barricaded round with bones.

As the smallest fly might incommode its polished surface, it is further protected by two substantial curtains.

In sleep, when there is no occasion for the sense, but a necessity to guard the organs, the curtains close of their own accord.

At other times, if danger threaten, they fly together as quick as thought.

They are lined with an extremely fine membrane, moist with its own dew.

Its bristly palisades ward off the sweat of the brow, and moderate the too strong impressions of the light.

As in our waking hours, we have almost incessant need for these little orbs; they run upon the finest castors, rolling every way with the utmost ease; which circumstance, added to the flexibility of the neck, renders our two eyes as useful as a thousand.

The ear consists of an outward porch, and an inner room.

The porch, somewhat prominent from the head, is of a cartilaginous substance, and wrought into sinuous cavities.

These, like circling hills, collect the wandering undulations of the air, and transmit them with a vigorous impulse to the finely stretched membrane of the drum.

This is expanded upon a circle of bones, over a polished, reverberating cavity. It is furnished with braces that strain or relax, as the sound is faint or strong.

The hammer, and the anvil, the winding labyrinth, and the sounding galleries, these and other species of mechanism, all instrumental to hearing, are inexpressively curious.

Amazingly acute must be the auditory nerves, since they answer the smallest tremors of the atmosphere, and distinguish their most subtile variations when combined.

These cords, turned by an Almighty hand, and spread through the echoing chambers, receive all the impressions of sounds, and propagate them to the brain.

These give existence to the charms of music, and the still nobler charms of speech.*

The eye is useless amidst the gloom of night; but the ear hears through the darkest medium.

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* The first music of the Romans came from the Etruscans: it was rude, and without principles; but they afterwards transported the Grecian music into Italy. The first Roman who wrote on music, was the famous architect, Vetruvius.

If Greece had her Timotheus, and her Tyrteus, who produced such great effects on their hearers, Italy had her Stradilla, and Palma, who also, as it is said, did astonishing things. Stradilla, by playing on the violin, softened the heart of a villain, who intended to have murdered him. Palma, a Neapolitan singer, suffered himself to be taken by a creditor, who came to arrest him; to whose threats and injurious terms, Palma only replied by singing

The eye is on duty only in our waking hours ; but the ear is always accessible.

As there are concussions of the air, which are discernible only by the instruments of hearing, so there are odoriferous particles wafted in the air, which are perceivable only by the smell.

The nostrils are wide at the bottom, that more effluvia may enter ; narrow at the top, that when entered, they may act more strongly.

The streams that exhale from fragrant bodies, are far beyond imagination.

Microscopes that shew thousands of animals in a drop of water, cannot bring one of these to our sight. Yet so exquisite are the olfactory nerves, that they arrest the vanishing fugitives ; they imbibe all the roaming perfumes of the spring, and make

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several airs, and accompanying his vocal powers with the harpsichord. The creditor's anger subsided, by degrees, and he was, at last, so perfectly calm, that he not only *remitted the debt*, but gave Palma ten pieces of gold, to assist him to pay his other creditors.

> "*Music has charms to sooth a savage heart,*
> *To soften rocks, and bend the knotty oak.*"

us banquet even on the invisible dainties of nature.

Another capacity for pleasure, which our bountiful Creator has bestowed on us, is the power of taste.

This is circumstanced in a manner so benignly and wisely, as to be a standing PLEA for temperance, which sets the finest edge on the taste, and adds the most poignant relish to its enjoyment.

To all these, as a most necessary supplement, is added the sense of feeling.

The crowning gift, however, which augments the benefits accruing from all the senses, is reason.

After having admitted, in its fullest extent, every fair comparison that can be made, between man and the most perfect of the other animals; acknowledging that both have bodies of matter, organized in many respects alike; that the bodies of both are made up of bones, muscles, and blood vessels; organs of respiration, circulation, and digestion; that both have brain and nerves, apparently of the same sub-

stance and texture ; that in both, are the powers of will, of sensation, and of motion: that both possess five senses of the same nature, and have a resemblance in many of their appetites, and inclinations ; after all those concessions, the internal faculties of the most intelligent of the brute creation, will be found, upon a just estimation, at a prodigious distance beneath those of man.

The actions of the one seem to proceed from the impulse of some want, the incitement of some appetite, or some controling spring within them, which obliges them to perform the same thing, in the same manner; so that all their boasted works, the labours of every species, and every individual of the species, are as uniform, as if they had all been cast in the same mould. This appears in their nests, in their cells ; for all their works, which astonish us, are formed by an inevitable necessity, like the growing of a plant, or the crystallization of a salt.

One race of the most intelligent species never improves upon a former, nor one individual upon another.

At the end of the elephant's long life, what does he know, that he did not know at the beginning? What does the young elephant know from the experience of his father?

Even attention to their young, the most universal, and most amiable part of the character of irrational animals, seems independent of sentiment and reflection, and to proceed from the same blind impulse, which prompts them to build such a kind of nest, and sit such a time on their eggs; for after a short period, those young are entirely neglected, and no trace of affection or the smallest tender recollection, seems any longer to subsist between the parent and the offspring.

How different is this from the sensation of the human species, where the father and the mother feel their youth restored, and their existence multiplied in their children, whom they endeavour to turn from the al-

lurements of folly; and by creating in their minds, a desire of knowledge and useful attainments; they save from the wretchedness of vacancy and contempt, attendant upon ignorance; who encourage their exertions, and support them under disappointments; whose chief happiness depends on the prosperity of their offspring, and who feel the approach of age, without sadness; while the evening of their lives is brightened by the rising reputation of their children.

To see a father treating a son like an elder brother, and to see a son covet his father's affection, company and conversation, because he regards him as the most amiable friend of his acquaintance, is the most agreeable picture which the eye can behold. It is a transplanted self-attachment, as sacred as friendship—as pleasurable as love—and as happy as religion can enrich it.

Sometimes by the strong and harmonious voice, man is found celebrating, in a poem, the virtues of a hero!

At other times, we behold him on the floor, in the senate of his country, supporting her rights, and defending her wrongs, amidst the conflict of contending passions,

In the glorious cause
Of Justice, Mercy, Liberty, and Laws.
Who calls to virtue's shrine *Columbian youth*,
And shake the senate with the voice of truth;
Rouse the dull ear, the hoodwink'd eye unbind,
And give to energy the public mind.
While rival nations, with blood unsated, wage
Wide wasting war, with fell demoniac rage,
In every clime, where army army meets,
And ocean groans beneath contending fleets,
Oh save! Oh save! in this eventful hour,
The *tree of freedom* from the AXE of power:
With fostering peace the suffering nation bless,
And guard the freedom of the immortal press.

At other times, by a stroke of the pencil, he changes a dull and flat canvass, into a charming perspective.

Hence to clear images of form belong,
To Titian's* pencil, and the poet's song,
The artist's landscape, and the builder's† plan,
'Tis imitation—marks the favoured creature—
MAN.

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* Trumbul † M^c Combe

There do we see him, with a chisel and graver in his hand, imitating the marble, and giving life to brass.*

Here, with the plummet and square, erecting a magnificent palace.†

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* John Baptista Tuby, called the Roman, held a distinguished rank among the artists in marble, who appeared in the reign of Lewis xiv. The mausoleum of the Viscount de Turenne, interred at St. Dennis, was designed by Le Brun, and executed by Tuby. Immortality is seen holding a crown with one hand, and sustaining Turenne with the other; Wisdom and Virtue standing on each side him, the first astonished at the fatal stroke which had deprived France of her hero; the other plunged in astonishment.

John Balthazer Kelly, incomparable in the art of casting in bronze, or brass, was born at Zurich, in Switzerland. He went to France; where, on the last day of December, 1692, he produced the equestrian statue of Lewis xiv. which was twenty-five feet high, in a solid. This admirable piece of workmanship arrested the passing stranger, with wonder and admiration. Indulging fancy's airy flight, he *gave life to brass.*

We live to hope the period not distant, when the Genius of Columbia will present a Le Brun and a Tuby, to design and execute a monument, to perpetuate the memory of the distinguished virtues of the immortal WASHINGTON; the patriot—the friend of man—the father of his country; who has passed from us, and left alone, behind, his chaste example, to cheer us in the exercise of virtue, and love of country. His memory has a monument in our grateful bosoms.

† Ancient authors allow the Egyptians to have been the first who built with symmetry and proportion; but Greece

Now do we behold him by the assistance of a microscope, of his own invention, discovering a new world, amidst invisible atoms, or penetrating the secret exercise and structure of a particular organ.

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ought to be regarded as the birthplace of good architecture. The best days of architecture, among the Grecians, it is said, were the age of Pericles. Among the Romans, it arrived at its highest perfection in the time of Augustus, when the famous pantheon was built. It began to be neglected under Tiberius and Nero: 'was raised again by Trajan, and protected by Alexander. Severus could not impede its downfal with the Empire of the West; from the ruins of which, it did not rise again for several ages. It then took a new form, called Gothic; which subsisted wholly, till Charlemagne endeavoured to re-establish the ancient mode. Architecture then became as much too light, as it had before been too heavy. The builders, at these times, placed their beauties on a delicacy, and profusion of ornaments, till then unknown; which taste they received from the Arabs and Moors, who brought it into France from the southern countries, as the Goths and Vandals had brought the heavy Gothic from the North. It is only within these two centuries, that the architects of England, France, and Italy, have applied themselves to recover the beauty, simplicity, and proportions of ancient architecture.

Thus did great WREN
Fix the vast pillars of the sacred dome,
Rear'd rocks on rocks, sublime.†

Who will prescribe limits to the rising Genius of Columbia, in the arts and sciences? Or why should we yield to the ancients, a palm which we ourselves can attain?

† *St. Paul's Cathedral.*

At other times, by changing this microscope into a telescope, he pierces into the heavens, and there contemplates Saturn and his ring.*

Returning home, he prescribes laws to these celestial bodies, describes their path, measures the earth, and weighs the sun.†

Afterwards, directing his attention towards the more useful study of organized beings, he dives into the laws of the animated fibres, examines the relations of differ-

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* The celebrated Dr. Herschel, some years since, discovered a star, in regions so remote, that no human eye had ever before seen it. For this achievement, his name is recorded in the starry firmament: this important discovery is proclaimed as far as civilization extends.

Our illustrious countryman, David Rittenhouse, who rose from a respectable watch-maker and farmer, acquired, by his *perseverance*, the science of astronomy; and in 1769, he was requested, by *The American Philosophical Society*, to observe the transit of Venus; which, to his honour, he did, with surprising accuracy. He succeeded the venerable Franklin, as president of that society, which office he filled with high reputation. He died in 1796.

† The sublime genius of Newton enabled him to discover and unravel the mysteries of nature. By the amazing powers of his mind, he traced her through all her operations, and taught us to admire the greatness of the Almighty, by making us familiar with his works.

ent parts, and by an attentive view of the various perfeetions, he sees a chain which comprehends the whole.*

But the most perfect mark of the greatness of man, and his high exaltation above other animals, is the commeree he holds with his Creator.

Wrapped in the thiekest darkness, the rest of the animal ereation are ignorant of the hand that formed them. They enjoy an existence, but eannot traee the Author of life.

Man alone soars to God, the principal of all existenee ! prostrate at the foot of the throne of the Almighty, he adores with the profoundest sentiments of veneration ; he feels the most lively gratitude towards the ineffable goodness of his Creator.

" Know, then, THYSELF ! presume not God to scan ;
The propper study of mankind is MAN."

* This doctrine is beautifully displayed by that first of anatomists and naturalists, the late John Hunter, who discovered also the absorbent system : we believe we may say it is almost universally adopted, and, in due time, may be ranked the greatest discovery, both in physiology and pathology, that anatomy has suggested, since the discovery of the circulation of the bood.

Circulation of the Blood.

We will attempt, in this section of our plan, an illustration of the manner in which the *crimson tide* is conducted from the salient angle, the heart, through various meandering *canals*, in the *vital city*: which anatomists, in their analysis of the various departments attached to anatomy, refer to under the term

Angiologia,

OR

DOCTRINE OF THE VESSELS.

We presume the most eligible mode of conveying our ideas to the various classes of readers, will be to present this important part of the subject in the form of

Dialogue.

How many kinds of vessels are there in the human body?

Two; the sanguiferous, and lymphatic?

How are the sanguiferous vessels divided?

Into arteries and veins.

What is an artery?

An artery, is a membranous canal, dividing itself into innumerable branches, and conveying the blood from the heart to all the different parts of the system.

What are the veins?

The veins are membranous canals, of a conicle figure, returning the blood from all the different parts, to the heart.

What are the lymphatics?

They are small pellucid tubes, whose cavities are connected at small and unequal distances: they are likewise called absorbents, and are found in every part of the body.

What is meant by lymph?

A crystalline, tasteless fluid, contained in all the absorbent vessels, except the lacteals, which convey chyle or nutritious fluid into the blood.

What are the coats of an artery?

Three, an external membranous, middle muscular, and internal membranous coat.

What are the coats of the veins?

The same as those of the arteries.

In what respect do the veins differ from the arteries?

They are thinner and weaker; their diameter is greater; there is a greater number of them, than of the arteries: they also differ from the arteries, in being furnished with valves.

What is a valve?

A kind of a membrane which opens to admit the blood to pass in one direction, and shuts to prevent a retrograde motion.

What other functions do the arteries perform, independent of propelling the blood from the heart, to the different parts of the body?

They secrete the various fluids, essential to nutrition and they expel from the system whatever may be injurious to health.

How do we prove that the blood circulates?

If a wound be made in a large vessel, the blood will continue to escape from it as long as the heart acts: if a vein be compressed by means of a ligature, it will be found to swell below: if an artery be compressed, in the same way, the swelling will be above the ligature, and no pulsation will be felt below it. In the tails of some animals, the blood, with a microscope of great magnifying powers, may be seen, passing from the extremities of the arteries into the veins: liquors injected into the arteries after death, are returned through the veins.

What parts of the body have a circulation different from the rest?

The brain, liver, and sexual system.

What is the mode of circulation in the brain?

The arteries, going to the brain, terminate in the veins, as in other parts of the body; but the veins in their course open into sinuses, and from these sinuous veins begin, which return the blood to the heart.

How do these sinuses differ from the veins?

First, in their shape, which is triangular: second, their texture, which is firmer: and thirdly, they have no valves.

What is the circulation in the liver?

The veins which bring back the blood from the abdominal viscera, or contents of the belly, (the kidney, and sexual system alone excepted,) unite to form a large trunk, called the vena portarum, or great vein of the liver, which, after entering the liver, becomes divided into very small branches, through which the blood destined for the secretion of bile, is conveyed. These branches communicate with the ramifications of the veins, which return the blood from the liver to the vena cava; (or principal trunk,) so that the vena portarum may perform the office of an artery.

What is the general circulation of the blood?

The blood, being brought by the veins from the extremities of the body, to the right auricle, or chamber of the heart, by the contraction of the auricle, is so propelled from the right ventricle: this im-

mediately contracts, and the return of the blood into the ventricle, being prevented by the valvula tricuspidates, (or three pointed folding,) the blood is thrown into the pulmonary artery, by which it is distributed through the lungs, whence it is brought by the four pulmonary veins, to the left auricle, whence it passes into the left ventricle; and then into the aorta, from the branches of which, it is distributed throughout the body, and is brought back by the veins of the right auricle.

What prevents the blood from returning into the right ventricle, after passing through it?

Three semilunar, or half moon like valves, which are placed at the begining of the pulmonary artery. Three valves of the same name are placed at the commencement of the aorta, (or great artery of the body,) to prevent the blood from repassing into the left ventricle.

What prevents the blood from repassing from the left ventricle into the left auricle?

Two valvulæ mitrales, (or mitre like valves.)

Which are the principal branches arising from the aorta ascendens?

First, the coronary arteries which go to nourish the heart: second, a branch common to the right carotid in the neck, and right subclavian, or under the collar-bone: third, left carotid: fourth, left subclavian. The carotids are divided into external and internal; they supply the different parts of the head with blood.

At what place do the carotids become divided into two branches?

Opposite to the larynx, or posterior parts of the lower jaw.

At what place does the internal carotid enter the head?

Through a foramen, or passage in the petrous portion of the temporal, or temple bone, and is distributed to the brain and its membranes.

On what other parts is the external carotid distributed?

On the external parts of the head, the larynx, pharynx, or superior portions of the skull, the jaws, lips, tongue, eyes, &c.

Which are the principal branches of the subclavian artery?

First, the internal mammary, or breast: second, cervicle, or neck: third, vertebral, or spine: and fourthly, superior intercostal, or between the ribs.

What is the subclavian artery called, after it reaches the axilla, or arm-pit?

The axillary artery.

What is it called, after passing through the axilla along the upper arm?

Brachial artery.

How is the brachial artery distributed after sending off many collateral branches?

It is divided at the cubit, or elbow, into two principal trunks, called the cubital, and radical arteries; which are felt at the wrist: the cubital sends off the external and internal inter-ossial arteries, (or between the bones) of the fore-arm.

What are the principal branches arising from the trunk of the aorta descendens?

First, the bronchial arteries attached to the respiratory organs: second, those of the œsophagus, or gullet: third, intercostals, (between the ribs;) those belonging to the thorax, or breast. In the abdomen, the aorta gives off eight pair of arteries, and three single ones which arise in the following order.

First, the phrenic, which go to the diaphragm: second, cæliac, which divides into three branches; the coronary going to the stomach; hepatic going to the liver; and splenic going to the spleen: third, the superior mesenteric, which is distributed to the small intestines: fourth, the emulgents, which carry the blood to the kidneys; fifth, spermatics: sixth, the inferior mesenteric, which is lost upon the large intestines: lastly, five pair of lumbar arteries; the aorta then divides into the two iliacs: the iliac artery is divided into external and internal.

To what parts is the internal iliac artery distributed ?

To the different parts contained in the pelvis, or bason, which supports the contents of the abdomen.

How is the external trunk of the iliac continued ?

It passes under Poupart's ligament, along the inner part of the thigh : whence it is called the femoral artery ; and passes to the ham, and is there called the popliteal artery : in this place, it is divided into two branches, viz. tibialis antica, and postica, (before and behind the shin-bone.) The posterior tibial artery sends off several branches.

Which are the principal veins in the body ?

The four pulmonary veins, the superior and inferior cava, and the vena portarum.

By what powers is the blood carried through the whole system ?

In the arteries, it is propelled by the action of the heart ; by the muscular fibres of

their coat; and by their elasticity. In the veins, it is carried on by the same principles as in the arteries.

Which contain the most blood during the circulation; the arteries, or the veins?

The veins; the proportion being as nine to four.

Do the veins in any part of the body appear to be endowed with muscular coats?

Yes: in the cava near the heart, and in the pulmonary veins, they are conspicuous; and it has been proved by the experiments of Dennison and Verschuerius, that they do contract: Harvey has observed, that the motion of the right ventricle was the last that ceased; and after even this was silent, Whytte observed that the vena cava still continued to contract.

To whom is the discovery of the circulation of the crimson tide justly attributed?

To the immortal William Harvey, who chased away the clouds of false conclusions, and presented the world a legacy of invaluable worth. He was born at Folkstone,

in England, in 1578, and published the discoveries of his vast labours in the year 1628. He died in 1657, leaving his estate to the college, to which he had before built a library, museum, and combination room. Noble patriotism! worthy of himself, and of imitation!

Recapitulation.

This illustration presents itself under two points of view : first, the disposition of the blood vessels; and, second, by the construction of the engine for forcing the blood through the vital city.

First. The disposition of the blood vessels, or canals, as far as regards the supply of the body, is like that of the conduits in a city : the large trunks branching off by smaller tubes, and these again by still narrower, in every direction, and towards every part in which the fluid they convey can be wanted. So far the water-pipes may analogically represent the vessels which convey the crimson tide from the heart!

But there is another consideration necessary to the blood, which is not wanting for the water ; that is, the returning it to its source. For this purpose, a reversed order of vessels is contrived, which uniting at their bases with the extremities of the first order or arteries, collect the divided

and subdivided streamlets: first, by exceeding small separating branches into larger: secondly, by these branches into larger canals or trunks, and thus returns the vital tide, almost exactly inverting the order at which it was propelled from the salient angle.

Our bodies, therefore, contain two combinations of blood-vessels: arteries and veins. Between the constitution of the systems, there are also differences, suited to the functions which the systems exercise. The vital fluid, in sallying out, passes always from wider into narrower tubes; and in *returning home*, from narrower into wider.

The arteries are cautiously defended and secured from injury, not only by their texture, but by their situation; and every advantage which can be given them. They are deeply intrenched, or creep along grooves, formed for them in the bones, for instance, the under edge of each rib is sloped and furrowed, for the passage of these vessels. Sometimes they proceed in

channels, protected by stout *parapets* on each side, which last is remarkable in the bones of the fingers: at other times the arteries pass in canals, wrought in the very substance, and in the middle of the substance of a bone; this takes place in the lower jaw, and is found where there would otherwise be danger of compression, by sudden curvatures. as in the spine, or back. This care is wonderful, yet not more so than what the importance of the case required!

Second. Our next consideration will embrace a few thoughts on the engine which works this machinery: viz. the heart. It is not necessary here to review the principle upon which it acts; but to inquire how a power is applied in the instance before us.

The heart is a hollow muscle, occupying the central part of the body, invested with spiral fibres, running in opposite directions, the layers intersecting each other. By the contraction of these fibres, the sides of the muscular cavities necessarily squeeze together, so as to force out from them the

fluid which they may contain: by the relaxation of the same fibres, the cavities are in their turn dilated, and, of course, prepared to admit the fluid which may be poured into them. Into these cavities are inserted the great trunks, (or canals) both of the arteries which carry out the blood, and of the veins which return it.*

This general detail of the apparatus connected for circulating the vital fluid, is the most lively idea of its action; that by each contraction, a portion of blood is forced, as by a syringe, into the arteries, and at each dilatation, an equal portion is received by the veins.

Of those who venture their lives on board a ship, it is often asserted, that a plank is

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* The aorta, or principal artery of a whale, it is said, is larger in the area, than the main pipe of the water-works at London-bridge: the water roaring in that pipe, is inferior in impetus and velocity, to the blood gushing from the heart of this monstrous animal.

D. Hunter's account of the dissection of a whale says, "the aorta measured a foot in diameter; and that ten or fifteen gallons of blood are forced out of the heart at a stroke, with an immense velocity.

the wall of partition between life and death; but in the body, especially in the arterial system, there is, in many parts, only a membrane!—a film!—a thread!

An elegant writer (Hamberger) says, "the wisdom of the Creator is in nothing seen more gloriously displayed, than in the heart." How well does it perform its function! notwithstanding the complexity of its mechanism, and the delicacy of many of its parts, it might be supposed to be liable to derangement; yet shall this wonderful engine labour night and day, for eighty years, at the rate of a hundred thousand srokes in twenty-four hours, having, at every stroke, a great resistance to surmount, and still continue its action for this period, without disorder, or fatigue!

DIFFERENT CLASSES IN ANIMATED NATURE.

There are six classes: viz. animals having the

Heart furnished with two ventricles and auricles. Blood warm and red.	Viviporous—Mammalia.
	Oviporous—Birds.
One ventricle and auricle. Blood cold and red.	Respiration voluntary, Amphibia.
	Breathing by gills, Fishes.
One ventricle with one auricle.	Antennated—Insects.
Saines cold and colourless.	Tentaculated—Vermes.

The number we present of each class of animals, are,

1 Mammalia, affording milk,	53
2 Aves, or the feathered tribe,	195
3 Amphibia, partaking of two elements,	25
4 Pisces, or fishes,	79
5 Insects,	1692
6 Vermes, or worms,	198

Having presented the Plan, with the noble Elevation attached to it, and directed a character to the varied departments in the ANIMAL ECONOMY, to show the whole a complete masterpiece of creating skill; let us in the next place, reflect on, and consider the manner in which the latent vital principle is nourished and excited into action, and the means by which it affords a constant evolution of

Animal Heat.

It is worthy of observation, that men, in a living state, together with the other subjects belonging to the class mammalia, as well as the whole feathered race, are distinguished from the rest of the animal kingdom by this peculiarity, that the native heat of their bodies far exceeds, in degrees of temperature, the usual heat of the medium or element, in which they live. With respect to man himself, it is, however, to be remembered, that he appears to be in-

ferior in the heat of his system, to those other kinds of animals we have just mentioned. Thus, in our climate, the heat of the human body generally stands at about the 96th degree of Fahrenheit's scale; whereas, in other animals belonging to the class mammalia, the vital temperature very considerably exceeds this point, while it ascends still higher in individuals of the feathered tribes.

The degree of native heat possessed by a healthy person, is so constant and uniform, that, in general, (provided we make allowance for the state of health peculiar to each individual) its range will include but a very few degrees of the thermometer, whether the subject be exposed to the inclemencies of the most rigorous climate, or placed beneath the fervors of a tropical sky; for the opinion formerly delivered by Boerhaave, that man has not a power of existing in a medium of such a nature as exceeds, in temperature, the native heat of his own body, has, since the famous observations of that illustrious traveller, and for-

mer governor of Georgia, H. Ellis, been refuted by a great number of characters, learned in the science of physiology, and the reverse completely demonstrated and established by experiments well adapted to the nature of the subject. In this particular, indeed, appears to consist one of the great prerogatives of MAN; that imprisoned and confined to no one climate, or zone of the earth, he is able to pass his life in any section of the immense globe we inhabit, and is free to fix his habitation either beneath the rigours of Hudson's stormy region, where the quicksilver sinks into a state of complete congelation; or in the bosom of those glaring solar fires, which scorch the glowing shores of the Senegal.

Many hypotheses were advanced by the ancients, to account for the origin and source of that astonishing fire which minutely pervades our bodies, and uniformly supplies them with the necessary degrees of warmth; but their opinions were enveloped in obscure conclusions, until that

justly celebrated character, J. Mayow, sketched out the leading traces and first great outlines of this doctrine, which in our time has been greatly improved. The lungs are now justly considered as the focus, or *fire-place*, where animal heat is generated, and the dephlogisticated part of the air, which we breathe, the *fuel* that supports the vital *flame*. This doctrine has been greatly extended, and further elucidated by the labours of the illustrious Crawford, who appears to be the first who attempted to ascertain, by direct experiments, the cause of animal heat, as depending upon the air.

Modern chymistry assumes to itself, the discovery of the origin of animal heat, which is supposed to depend on those changes in the ingesta, or food, which the functions of life are always producing, among the breathing animals: the principal of these changes, is occasioned by the lungs, on the atmospheric air, which they inhale; and respiration is considered as the principal source of the heat of this class of ani-

mals. That the oxygen (or vital air) contained in the atmosphere, furnishes the largest proportion of the pabulum (or provender) of life, is now scarcely doubted; respiration being a process in which it passes from its gaseous to its concrete state; giving out a portion of the heat it held in vapour, in the same manner as steam, in its conversion into water, gives out a portion of its heat; the heat then extricated, being conveyed, by the circulation, to all parts of the body, is the principal means by which the whole is warmed and animated.

Parallel,

Between Animal Life, *and the* Burning of a Lamp: *concluding with an allegorical illustration of the diseases of old age extinguishing the lamp of life.*

If an animal be placed in the exhausted receiver of an air pump, it quickly expires; in similar circumstances, a burning lamp goes out—If an animal be not supplied with fresh air, it dies, and its heat is extinguished; so it is with the lamp—The air breathed by animals is diminished in quantity; so it is by the burning of the lamp—A certain quantity of air supports an animal a certain time, but no longer; so it will keep up the flame of the lamp, for a certain time only. The air in which a lamp has burnt out, destroys animal life; so the air that the animal hath breathed, puts out the lamp—Fixed, azotic, and inflammable airs destroy animals; so likewise do they extinguish the lamp.

A living animal, and a burning lamp, therefore exactly agree in requiring the same kind of air to support them, and in producing the same effects upon the air to which they are exposed.

But they do not resemble each other only in producing heat, and requiring the same kind of air; for if an animal hath not fresh supplies of food, as well as air, after a certain time it dies, and becomes cold; just in the same manner as the lamp dies, if not duly supplied with oil or nutriment.

Old Age,

Commences with the aberrations of the mind. Perceptions are less lively in old men; the ideas and images of things are confounded, and the memory decays; whence the intellectual faculties must necessarily lose their strength or power by degrees. Cicero says, that reason is the light and splendour of life. Thus, the faculties of the mind decaying, may be compared to the luminaries of the world obscured.

INFANCY.

The morning of life has its peculiar charms; and every feeling heart knows them to be irresistible: innocence, helplessness, playfulness, freshness of constitution, and of colour, with the consideration, that it is advancing to maturity, all conspire to recommend this period of life to our love, by suggesting a thousand delightful ideas.

Although, with some, the last period of life, like the evening sky, is often distinguished by a lustre, not dazzling, indeed, nor ardent, like the splendour of noon, but

no less pleasing to a contemplative mind. A *fresh* old age, with cheerfulness, good sense, and an approving conscience, are the most venerable of all terrestrial attainments.

"The age worn fibres, goaded to contract,
By repetition, palsied, cease to act;
When time's cold hands the languid senses seize,
Chill the dull nerves, the lingering currents freeze:
Organic matter, unreclaim'd by life,
Reverts to elements by chymic strife."

"Hope humbly then, with trembling pinions soar,
Wait the great teacher, death, and God adore."

ANALOGICAL VIEW

OF

PLANTS AND ANIMALS.

PART I.

CREATED nature, by successive seeds, with the assistance of the elements, modifies earth into vegetables, vegetables into animals; perhaps, not contrariwise, she decomposes them each again into earth, in a perennial circle.

Vegetables have life, without voluntary motion: they are commonly divided into three tribes.

The nations which have supplied this conflux of inhabitants, are, principally,

PALMS.

Princes. Vegetables of India; eminent for their prodigious height; beautiful for their unvaried, simple, perennial stem; crowned with an evergreen tuft of leaves; enriched with the choicest treasures of fruit. They are tributary to the first order

of animals; in particular, to the prince, their inhabitant.

GRASSES.

Plebians. Plants of the field; rustics; the most common, the most simple, and the most tenacious of life; constituting the multitude and strength of the vegetable kingdom: and which, the more they are *taxed* and *trod* upon, the more they multiply. These are tributary, for their vile beards, to almost all herbivorous animals; and by their harvest in particular, to the prince, their inhabitant.

LILIES.

Patricians. Luxurious inhabitants of groves; bulbous rooted plants; displaying their shining, festive garments, they amuse the eye, and adorn the vegetable kingdom, with the splendour of courts.

HERBS.

Nobles. Meadow plants; annual; of many forms; they enrich the kingdom of

vegetation, by their admirable structure, variety of tastes, fragrant odours, and gorgeous colours.

TREES.

Highnesses, of the order of nobility. Inhabitants of the woods; perennial, as to their stock; surrounded with *servants* at their feet, and supporting destructive parasites; they ereet their heads, resist the winds, overshadow the sultry, moisten the the day with invisible showers, allure the birds, and present their fruit, like so many orehards of nature.

SOLDIERS.

Plants. Armed with thorns, or prickles: from both of the last kinds, they repel the attacks of the mammalia, or first class of animals.

NEW COLONISTS.

Ferns. Plants of obscurity, supported on stipes, with seeds on their backs;

poor: these prepare the earth for their successors.

MOSSES.

Servants. Plants of the winter; hungry; occupying, in immense numbers, all the places relinquished by the former: these protect the roots of other plants, lest they should be injured by the frosts; the summer heats; the vicissitudes of spring; or the putridity of autumn; and collect, for the benefit of others, the nutritive soil.

FLAGS.

Slaves. Plants which love the water; squalled; revivescent; abstemious; almost naked. These begin the first vegetation in uncultivated plains.

FUNGUSES.

Vagabonds. Plants of the autumn; barbarous; naked; putrescent; rapacious; voracious. These, at the fall of the leaf, are supported by the recrements of other plants.

The organization of vegetables consists of, first, vessels circulating fluids—second, vessels containing air—third, secretory vessels; and probably absorbents.

The substance which embraces the pith, consisting of a cellular cuticle, or *skin;* externally covering the bark, deposits on its interior side the rind, and is converted annually into rigid wood.

Our admiration is elevated in an astonishing manner, when we contemplate the multitude and variety of plants, spread by the fertile hand of nature, over the vast surface of the habitable globe; not so much to adorn and embellish it, as to preserve to man and other animals, both life and health.

What arrests our inquiry, then, is the nature and structure of plants, vegetable life with their maladies, &c.

A plant is an organized body, which is merely vegetative, and nourishes itself internally; grows, and propagates bodies of the same species, without a power capable of moving, or feeling. Thus we observe

in plants, organs fit for receiving, preparing, filtering, and circulating fluids, but none which seem destined for motion or sensation.

The microscope discovers in wood a great number of small pores, disposed in an annular, and orderly manner. The secretory vessels are almost oval, forming several ranges horizontally, in proportion to the axis of the plant, and united against each other.

From the fibres and vessels horizontally interwoven, result the bark, (which is analogous to the skin of animals) the wood, and pith. The bark is composed of a pellicle, or tissue of fibres, air, and secretory vessels, which are inserted into the wood. and the pith, or marrow comprises, as it were, a collection of vesicles, considerably like those of the solids.

Hence arise the roots, trunk, buds, branches, leaves, flowers, fruit, seed, and shoots. The roots are the fibres fitted for, it is supposed, absorbing the juices from the

earth : if so, these are analogous to the absorbent vessels in animals : the nutritive part of an animal's food is taken up by the lacteals of the intestinal tract, and transmitted into the system for the support and growth of animal life. Spallanzini, in an elegant allegory asserts, " man is an *inverted Tree.*"

The trunk is that part which arises from the roots, to the extremities and foliage, ordinarily in the form of a cylinder : the branches are a sort of young plants, growing out of the trunk : the leaves are productions of the fibres of the branches or of the trunk; and are expanded primarily in a small degree ; then undergo a further extension, from a plane to the circumference.

The flowers are almost like the leaf, a contexture of fibres, which proceed from the solid parts, but finer, and according to the texture and arrangement of the leaves : a rose, a carnation, or a pink is the product.

The fruit which is seen to grow ordinarily in the middle of the flower, contains the

seed, or grain: and what is this grain? It is a plantule, ready to be evolved.

The nutritive juices of plants are earths, oils, salts, &c. but more especially water. Different sorts of plants afford these principles in distillation: and it is well known, that water contributes to their growth. For, if in winter we set over a chimney-piece a glass vessel, full of water, and insert upon the surface of it any bulbous root, such as a hyacinth, tulip, jonquil, &c. the heat of the atmosphere in the room, is communicated to the water, an agitation is produced in the particles of the fluid by which it penetrates the fibres of the roots, and excites vegetation; the radicles first descending, the stalk ascending, we are presented, in a short period, with the fragrant nosegay.

To prove that water is the pabulum, or provender of vegetables, Van Helmont took two hundred pounds of earth, dried in an oven, and watered it: he then placed in it a willow which weighed five pounds: he closed this earth on all sides, in a vessel

which had small perforations for the admission of air, and watering it frequently, at the end of five years, the willow weighed five hundred and sixty five pounds : the earth, after it was dried, lost two ounces.

Duhamel de Corporum affectionabus, page 52.

This then, is manifest, that the moisture alone nourished the plant, and the earth was the *sponge*, to retain it. We shall adduce another experiment in confirmation of the above : let eight or ten pounds of earth be placed in a vessel ; three or four hundred plants may *sip* nutrition in this earth, and in the rain which may descend. This quantity of earth, with water intimately united, would not be sufficient to furnish nutrition to so great a number of plants ; it would be necessary that the whole mass weighed, at least, four or five hundred pounds ; and yet it would scarcely weigh twenty : hence different sorts of plants are nurtured with the same fluid.

These principles being admitted, we are led to review the growth of plants. The plantule having in its seed, (at least ordin-

arily) the radicle, trunk, leaves, pulp, or flesh, which surround it, is separated into two lobes, united by a delicate fibre, to the extremity of the radicle and trunk; the nutritive juices are agitated by gravity, their action proper to fluidity, and by the elasticity of the air which surrounds it, a peculiar fermentation is excited in the seed, penetrates the pulpy matter, shoots out into fibres and roots, and from the trunk into the leaves, enveloped into small masses, insensibly, or almost so, evolve the leaves, roots, &c.

In the first stages of vegetable life, water is a source of delicate nutriment to the plantule, until it hath produced radicles, capable of receiving and digesting grosser fluids; so in the first stages of infancy, milk is the proper food of the young animal, till that period when a power to digest a grosser aliment arrives.

A question presents, why the roots descend into the earth, while the stalk arises from it? This seems a sort of affecta-

tion : the root bows itself in order to descend, while the trunk forms an angle to ascend.

Six acorns were planted with their points upwards, as perpendicular as possible : in two months after, on removing the earth from them, it was found that the roots had made an angle to descend ; as if they had been sensible of the *fraud* of the botanist. What, then, gives to the root and stalk these kinds of opposite directions ?

It is probable, that the pores and fibres of the roots are greater than those of the trunk ; since the roots are considered as the stomach of the plants, in which the grosser fluids are digested. Wherefore, when the nutritive juices circulate from the roots into the tender plant, through the fibrous ducts, which unite it to the pulp, the grosser, from the laws of gravitation, pass into the roots, and the more volatile into the trunk ; which, having ascended into the air, meets no resistance to its elevation. On the contrary, the roots, in proportion as they descend, always encounter

great resistance, to their motion downwards.

The pith of plants is analogous to the marrow of animals; and is a collection of small vesicles which seem destined to filter and elaborate a volatile juice, for the nourishment of the plant, flower, and fruit.

We may reasonably presume that the sap, in order to its being elaborated more firmly circulates in plants as the blood does in animals. For, if the sap ascends or descends, it circulates. When the trunks of two trees join their roots together, so that the juice of the one passes into that of the other, if we separate the trunk of the one in the month of February, two feet below the union of the trunks, the lateral branches which are below the contact of the barks, send forth small branches and leaves in the following spring, as well as those above; and as much so as if they received nutrition from the sources of the parent stock. Hence, they must receive, by this conjunction, a fluid which descends from the extremities towards the root, after hav-

ing ascended from the roots towards the branches.

The ligneous fibres convey the more volatile fluids towards the branches: the utriculæ bring back the juices towards the roots, which are not yet sufficiently digested, and the trachea furnishes air, which facilitates the circulation of the vital fluid.

PART II.

REPRODUCTION,

AND

FRUITFULNESS OF PLANTS.

THE lap of nature presents us a pleasing variety of plants and flowers, which many admire for nothing more than the gratification of sight, or fragrance. The virtuosso dwells on the rich structure and elegance of a plant, its foliage and splendid, variegated tints: but the philosopher delights in a more noble banquet: he investigates the reproduction and fruitfulness of the manifold families in the vegetable creation.

We have endeavoured to illustrate the origin &c. of plants; and have discovered that the fruit includes the seed; and that the seed envelopes a plantule, already formed, by the benign hand of nature, for perpetuating the species.

Our inquiry here leads to the constituent parts of flowers; and concludes with

some deductions referable to the analogy of plants and animals.

The constituent parts of flowers, at least the greatest part, have their petals, calix, stiles, stamina, and summits. The calix seems to envelope the sexual system of the flower: the petals, or leaves, are parts expanded, and situated about the germinating principle: the pistillum is a tube which arises from the bottom and middle of the petals: the stamina are fibres that spring from the base of the flowers, and terminate in different conformations, which are termed summits.

The tulip, for example, is composed of six petals, or leaves; from the base and middle of these arises a small tube: this is the pistillum; around which some very fine fibres are disposed, which also grow out of the base of the flower; these are the stamina.

The summits of the stamina are capsules, or vesicles, which, in their maturity, expand, and transmit a *father dust*, of different configuration, accordant to the varied families of the plant. Hence, the fari-

na of the summits renders plants fertile ; it being wafted by the gentle undulations of the atmosphere descends upon the *vital spark* which contains the fruit, and is there diluted ; penetrates the substance of the pistillum, and, after a short period, produces a fermentation, capable of inducing the embriotic plant contained in the seed to *burst* into vegetable life.

As the inhabitants of the ocean are different from those of the land, so has it plants different from those of the earth. Among the aquatic plants, some have leaves, others want them. The greater part have no apparent roots, but vegetate on hard bodies ; such as rocks and shells, to which they are attached by a small and polished base. These plants without roots are so organized, that their whole surface may be considered as capable of absorbing nutrition, by an infinity of porous ducts. Marine plants being thus surrounded by the waters which nourish them, possess an assemblage of small *glands*, which filter and separate from it, the lacteous, and glutinous particles.

PART III.

DISEASES OF PLANTS.

The most precious and singular plants have maladies, analogous to the maladies of animals, in the course of their vegetable existence.

Plants are indisposed, when healthy fluids are not circulated into their different organs: under such circumstances, they become languid: this languor is derived from several sources; first, an excess or defect of the nutritive fluid; or, secondly, the malignity of the fluids, or external violence.

The same causes excite similar effects in animals. Excessive repletion has produced a rupture of the vessels, and dangerous effusions. The juices inspisated in the vessels, for want of velocity and circulation, are obstructed, and congest. The fluids which ascend penetrate and gradually possess the trachea; which is, as it were, the *lungs* of plants; and arrests the

action of the air, free circulation is intercepted, and the plant sickens and dies.

Secondly. Defect of fluids produces the same result. If a great quantity of them is evaporated by transpiration, during the heat of a summer's day, if none arise to repair the depletion, the vessels become destitute of nutrition; collapse, lose their vitality, and become incapable of receiving new juices: hence the plant sickens, languishes, and often expires—of consumption.

Thirdly. The malignity of juices produces languor, and oftentimes the dissolution of plants, by decomposing their organs. Lime-water, or water of compost, and hot beds, too strong, cauterize the tender fibrils of the roots, from an excess of their corrosive salts. If the juices are too viscous, they inspissate, and become fixed: they cannot circulate, nor afford sufficient nutrition to the young embryo, in order to evolve; and a plant, far from producing fruit, famishes from a want of nurture, which conveys life into its constitution.

Fourthly. The fertility of plants is sometimes the cause of their diseases; plants too fertile are of less duration than others.

Fifthly. External violence, which causes maladies in vegetation are wounds, frost, heat, insects, parasitical plants, &c. &c.

Wounds are hurtful, and even prove mortal, to plants; as cutting the roots, divesting the bark, or otherwise destroying the ligneous parts, so that the covering only remains, the fluids cannot circulate.

Frost expands the juices, which it destroys; and rends asunder the fibres of plants. Heat agitates the fluid, violently attenuates and dilates the pores of plants, and compels the fluids to escape, by its immoderate action. In animals, heat exhausts the living principle, by the too powerful stimulus; hence they frequently sicken, languish, and lose their vigour.

Hail bruises the fibres of the foliage, and extravasates the juices; contusions in animals produce similar effects.

Insects, by their *nipping*, create tumours upon plants; this is followed by an ef-

fusion; the fluids escaping, penetrate the adjacent parts, where it is congested into a mass, dilates the fibres, and enlarges their capacity with concretions.

Parasitical plants are frequently more pernicious than the *pinching* of insects. Those live at the expense of others, as the moss and mistletoe tribes; they are real plants, the roots of which ingraft themselves into the bark of trees, extract the juices, and *steal* nutrition; and, by these means, debilitate, exhaust, and frequently destroy their *protector*.

The mould which appears in damp places, on the long neglected covering of a book, are small plants, of the species of moss, which moisture excites to vegetate; and which, when brought to the bar of the microscope, discover, in appearance, so many meadows, adorned with flowerets.

The seeds of parasitical plants are extremly minute: the winds waft them casually upon walls, roofs, and trees, where, being hospitably received, they vegetate.

Plants are provided with remedies in diseases; so are animals: gentle incisions diminish excess of fluid; bleeding diverts repletion: remove a portion of earth which conceals the roots, the air has more freedom of access to them; invigorates the plants, and a greater quantum of juices is absorbed. Mould and manure excite fermentation, and furnish materials, that *unlock* the torpid fibres, restore them to their former vigour, and remedy the mischief.

A wounded tree is not always without a remedy: if by accident, or otherwise, the arm of a tree is broken, and the bark not wholly separated, uniting the parts, and applying a retentive bandage, check the vital fluid from escaping, and prevent the air from dissipating the humours; it reuniting, the injured part is restored, and the fracture relieved.

SEQUEL.

It is curious to observe how the animal and vegetable families mutually support each other, through their whole existance. Vegetables, by emitting *vital air* during the day, purify the atmosphere, for the use of man and animals, while the fixed air expired by animals, affords nourishment to vegetables; but at the time when the diffusive stimulus is less wanting, sleep being necessary, the vegetable race pours forth *azotic air*.

It was Dr. Priestly who discovered, in 1772, that plants emitted vital air, and absorbed fixed air; for which discovery, he received the thanks of the royal society, in an elegant speech delivered by the president. "From your discoveries," says Sir John Pringle, "we are assured, that no vegetable grows in vain, but that from the oak of the forest, to the grass in the field, every individual plant is serviceable to mankind: if not always distinguished by

some medicinal virtue, yet making a part of the whole which cleanses and purifies our atmosphere. In this, the fragrance of the rose, and deadly nightshades co-operate; nor is the herbage, or wood, that flourishes in the most remote and unpeopled regions unprofitable to us; nor we to them, considering how constantly the winds convey to them the fixed air issuing from our lungs, while they exchange vital air for us."

Mr. Shoele having made some experiments diametrically opposite to this position, Doctor Priestly employed a whole summer to repeat his former experiments; and perceived, that upon many occasions, *azotic air* was given out, but confesses he could not discover the causes of this circumstance.

This laurel was reserved to decorate the brow of the laborious and ignenious Dr. Ingenhouz, physician to her Imperial Majesty.

He first shewed, that the trunk and foliage of plants gave out vital air only in the

presence of light. Hence, if you put a plant in water, in an inverted tumbler, and expose it to the rays of the sun, in a few minutes, air will be extricated, and, upon examining, will be found to be the purest vital air: or if successive plants be put in azotic air, it will be so ameliorated, that combustion may be supported in it, and it will possess the nature, and most probably, the same indentity as common air; or if a plant be exposed, under these circumstances, to inflammable air, it will form a truly explosive air. This philosopher, at the same time, discovered, that in the absence of light, not vital, but azotic and fixed airs were given out; and that even during the sunshine flowers, roots and ripe fruits always produced this deleterious air.

Hence he taught us the true relation we stand in with regard to the vegetable race; and he has also extended these curious and beautiful researches, by ascertaining the different proportions of vital air to the azotic air in different situations; and has de-

monstrated, that in a given quantity of atmospheric air, there is more vital air, in the country than in cities; and more near the sea than in land.

With what wonderful economy, then, has the Supreme Architect established this reciprocal intercourse between the animal and vegetable kingdoms! By what elegant simplicity of design, are the different parts of nature thus rendered at once subservient to the mutual support of each other, respectively, and to the general well being and harmony of the whole.

"Not every plant in every soil will grow,
The willow loves the wat'ry ground, and low;
The marshes *alder*: nature seems t'ordain
The rocky cliff for the *wild ash's* reign,
The baleful *yew* to northern blasts resigns,
To shores the *myrtle* and to mounts the *vines*."

VIRGIL.

ART AND NATURE

CONSIDERED AND CONTRASTED.

BEFORE we dismiss our pages on the Animal Economy, we shall proceed to examine the most exquisite performances of human art, and contrast them with the productions of nature: a parallel which must humble the pride of man, by presenting him a more reasonable and modest view of himself: and, at the same time, conduce towards the improvement of our imperfect conceptions of the supreme Governor of the universe.

We receive, through the medium of a good microscope, all the intelligence necessary to direct our attention to these grand objects. If the edge of a very sharp razor be examined with this valuable discoverer of truth, we shall perceive it to be as broad as the back of a knife; rough, full of indentations; and so unlike any thing

keen, that an instrument as blunt as this appears would not even serve to cleave wood.

H. K's Micrography.

The point of an exceeding small needle being examined, appears above a quarter of an inch in breadth; not round, nor flat; but irregular and unequal: and the surface, though extremely smooth and polished to the naked eye, seemed full of raggedness: in short, it resembled an iron bar, from a smith's forge.

Philosophical Transactions, No. 324.

A small piece of exceeding fine linen appeared, from the large spaces between its threads, somewhat like a hurdle, or lattice; and the threads as coarse as the yarn used in making ropes.

Some delicate Brussels lace appeared as if made of a thick, uneven hair-line, entwisted, fastened, and matted together, in a very awkward and unartful manner.

The web of a silkworm, being thus examined, appeared perfectly smooth and shining; every way equal, and much finer than any thread the best spinster can boast

of: or as the smallest twine is finer than the cable-rope. A pod of this silk, wound off, contains nine hundred and thirty yards; and as two threads are connected, it is a double line, equal to eighteen hundred and sixty yards; which being weighed with rigid exactness, was found no heavier than two grains and a half.

Philosophical Transactions, No. 324.

What an exquisite fineness is here! and yet this is nothing when compared with the web of a spider.

The most exquisite writing, such as the Lord's prayer within the compass of a silver sixpence, executed by an able master of the art, when brought forward for examination, presents a shapeless and uncouth product, as if written in rustic characters.

But the small specks on the wings or bodies of moths, beetles, flies, and other insects, are found, when examined, to be most accurately circular, and all the other lines and marks about them regularly and

finely drawn, to the utmost possibility of exactness.

These are some of the most curious and surprising works of art: but let us examine them with a microscope, and we shall immediately be convinced, that the utmost power of art is only a concealment of deformity; an imposition on our sense of vision; and that our admiration of it arises from ignorance of what it really is.

Miniature paintings appear, at the bar of this test, mere plastered tints, entirely void of regularity.

Thus sink the works of art, when we view them as they really are! On the contrary, the nearer we examine, the clearer can we discover and distinguish the works of nature, even in the least of her productions, the more sensible we must be made of the wisdom, power, and greatness of their Author.

View the numberless species of insects that swim, creep, or fly around us; what proportion and harmony shall we perceive in all their organs! what a profusion of

colouring; (as in the butterfly) azure, green, and vermilion; gold, silver, pearls, rubies, fringes, and embroidery, on their bodies, wings, heads, and every other part! How rich the glow! How splendid the finishing! How inimitable the polish we every where discover!

Search yet farther, and examine the animalcules, many sorts of which it would be impossible for the human eye, unassisted, to discern.*

The same order, regularity, and beauty, we discover among the vegetable tribes, if brought to examination. Every stalk, bud, flower, or seed, displays a figure, a proportion, a harmony, beyond the powers of art. Not a plant, nor a moss, whose leaf does not shew a multiplicity of vessels and pores, disposed most curiously, for the con-

* These atoms are so small that they can scarcely be discerned by the aid of glasses which possess the greatest magnifying powers: in them, however, we discover the same organs of body, multiplicity of parts, variety of motion, diversity of figure, and particular modes of living, as in the larger animals.

veyance of nutrition; and which is not adorned with innumerable graces to embellish it.

Hence, the most perfect works of art, betray a poverty and inability in the workman; but those of nature, prove the hand that formed them is Omnipotent.

It may be inquired by some, to what purpose has the Creator bestowed such an expense of beauty on so much insignificance?

Our reply is, that the beauty and elegance which adorn them, are evident and convincing proofs of their not being so insignificant as is presumptuously supposed; for such beauty and harmony, displayed in all the constituents of the organization of animals, is given them for the purpose of their perceiving, and attaching them to their own species: for ours, that we may observe in them the stupendous power and goodness of the Creator. If the former, we must allow them to be of consequence in the general account of their Creator; and if the latter, it is our unbounded duty to

take notice of, and admire. Therefore whatever the divine Author has been pleased to bestow on them; and what he has judged worthy to create, are not, surely, below a rational mind to examine, admire, and contemplate.

"See man from nature rising slow to art,
To copy instinct then was nature's part:
Thus then to him the voice of nature spake,
Go, from the creatures thy instruction take."

MISCELLANEOUS TRACTS.

It is an ancient and approved maxim, that a life, guided entirely according to the directions of art, must be a miserable one. And the most judicious practitioners, sensible of the justness of the observation, and that what is prohibited is often the most eagerly coveted, have endeavoured to give, even to persons labouring under disease, as great latitude as possible in the articles of diet; and to reconcile every part of the regimen they prescribe, as nearly as they can, to the common mode of living, in order that the patient may be reminded as little as possible of his misfortune.

With respect to quantity, it is evident that this must be regulated by our feelings; a healthy man may be said not to exceed in the quantity of his meal, if he finishes it with a relish for more; if immediately after eating, he can, if required, follow any employment that does not demand strong exercises, or violent exertions, which, to

persons in easy circumstances, will rarely be necessary, and ought in general to be avoided, as it disturbs digestion, though daily practised, from necessity, by the labouring poor.

Irritability is the principle of Life, and oxygen is the principle of irritability.

In palsied limbs, the muscles retain their sense of irritability, and faculty of motion, if there be applied a topical stimulus, such as electricity, galvanism, cautery, &c. But the nerves which go to the muscles are so diseased or compressed, that they do not transmit the impression of the will.

The difference between a paralytic, and a dead man is, that the paralytic is a dead man, who suffers; and the dead man is a paralytic, whose sufferings are finished.

What then shall we say of the inebriate, who, with this truth staring him in the face, is a paralytic with his own consent? But

with all this, he is not contented with putting an enemy in his mouth which, as Shakespeare says,

"Steals away our Brains."

He seeks to drive it out with another, that either impairs his constitution, or undermines his very existence.

Our Columbian Sydenham* has presented, in living tints, a prospective of the sad results of intemperance: in his inquiry upon the effects of spirituous liquors upon the human body, and their influence upon the happiness of society, he says, "They fill our church yards with premature graves—They deface the image of God in the soul—They derange or destroy the intellectual powers—They fill the sheriff's docket with executions—They crowd our hospitals with patients, and our jails with criminals—They lead to places of public ignominy and punishment."

Drinking intemperately is so ungentleman-like a vice, that it would be an affront

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* Dr. Benjamin Rush.

to suppose persons of polished manners could be capable of it.

We admit one generous glass of wine for digestion; a second for our relations; a third for the President of the United States; a fourth for our country; and *if* a fifth, *it* must be for our *enemies*.

Events arise from a fit of intemperance which are sometimes fatal, and always such as are disagreeable: with all man's reason and good sense about him, his tongue is apt to utter things out of mere gaiety of heart, which may displease his best friend: who then, would trust himself to the power of wine, if there was no other objection against it than this, that it raises the imagination, and depresses the judgment?

Supposing our claims to temperance are admitted, yet our readers will indulge us in presenting the following sentiments, when we have the pleasure to enjoy the company and conversation of well selected and intelligent friends:

First. May every just and liberal sentiment be nobly *expressed*, and fully *impressed*.

Second. May merit never be *depressed.*

Third. May no plan of public utility be *suppressed.* And,

Fourth, May Columbia's freedom never be *repressed.*

TO COMPRESS ALL,

May every useful thought be fully *expressed*, and duly *impressed;* and neither *repressed*, nor *suppressed*; nor any worth ever be *oppressed*, or *depressed.*

Common self-evident complaints require nothing more than common remedies: artificial complaints, which arise from *excesses*, are complex, and require the skill, and indeed the close attention of a physician. Imaginary complaints exist in the mind, and cannot be reached by any skill. We have, therefore, in the first instance, to consult Dr. Last; in the second, to resort to some able and judicious physician; and in the third, to invoke the aid of reason: this done, firmly and with discretion, nostrums would be annihilated, and empirics held at a distance.

Then would *temperance* and *prudence* be the purveyors of our pleasures. Then

would wholesome exercise brace our nerves, and diffuse over the countenance the glow of health. Then would keen appetite conquer palling satiety: and then would the operations of the kitchen triumph over the labours of the laboratory.

Nothing affords so pleasing a variety to life as action; and nothing so effectually dissipates painful sensations as the countenance and conversation of a friend. Nor with our friends only should we associate; the company of strangers may be of singular use, in sweetening our tempers, and refining our manners; for this requires more than ordinary attention to the civilities of social intercourse; it forces the mind into new exertions, which prevent the stagnation of the faculties, whereby the fancy is corrupted. It amuses, by offering to our notice a variety of new characters, and incidents; and, if we study to make ourselves agreeable, which is no more than our duty, it is beneficial to our temporal interest, by extending our acquaintance and influence.

Sleep.

Tired nature's sweet restorer cannot safely be dispensed with. View the blooming complexion of our peasantry—their strength and activity, compared with the sickly visage, and debilitated constitution of the sons of luxury, who turn night into day; and it clearly demonstrates which mode of life is most condusive to health.

They, after the toils of the day, are at peace with the world—They exert little attention to external objects—They anticipate the pleasing expectation of rich results from their industry. Retire—

" The shades descend, and midnight o'er the world
Expands her sable wings; *Great Nature* droops
Through all her works. How happy he, whose toil,
Has o'er his languid, wearied limbs diffused
A pleasing lassitude! He not in vain
Invokes the gentle deity of dreams·
Sleep, fast and deep, their active functions soon
With generous streams the subtile tubes supply;
Ere morn the tonic, irritable nerves
Feel the fresh impulse, and awake the soul.

Doctor Mackensie very emphatically observes, that he who sleeps long in the

morning, and sits up late at night, hurts his constitution without gaining time; and he who will do it merely in compliance with the fashion, ought not to repine at a fashionable state of bad health.

Hippocrates asserts, that *labour* is proper for the joints, *food* for the fleshy parts, *sleep* for the viscera, *walking* for the soul, and *thinking* for man.

It is generally admitted, that the perspirable pores can absorb not only the moisture that floats in the atmosphere, but a variety of foreign bodies, whether deleterious or medicinal, which may be applied to their orifices; and as the atmosphere, in certain situations, is loaded with unwholesome matter, may not clothing, properly regulated, be considered a *filter*, to separate the impurities of the air, before it comes into contact wirh the body?

Professor Boerhaave, who was born, lived, and died in a *flat bottomed* country, recommended this favourite receipt for the preservation of health in variable climates;

"to leave off our winter clothing on midsummer day, and to resume it the day following." May not this hint be reconcilable to those who live in the neighbourhood of marshy plains, lakes or positions, where the atmosphere is greatly charged with marsh miasma, or putrid exhalations?

To keep an animal in health, besides the retaining of a due degree of animal heat, there must be a continued generation of new juices, and an expenditure of the old. Without the due quantity of perspiration, which with us depends very much on our clothing, neither the vegetable nor animal can continue in health: a plant, as we have said, whose perspiration is *locked*, becomes sickly and dies; and an egg, whose shell has been covered with a varnish, and perspiration imprisoned by this means, will produce no living animal, either by the application of common heat, or that of incubation from the parent.

The celebrated Sanctorius affirms, that the insensible perspiration alone discharges more than all the sensible evacuations

together, and that the proportion of this to all the other evacuations, is as five to three; though this proportion varies in different ages, climates, and constitutions, yet it is of such importance in all, that where it is in any considerable degree deficient, a diseased state of the body must ensue.

The sympathetic sensibility of the surface of the body, is chiefly affected by the state of the perspirable pores; for it is only when these are *unlock'd* that the impression of the atmosphere on the skin produces catarrhs, rheumatism, and internal inflammations, in cold climates; and the external temperature in hot climates, being such as to keep the pores almost always open, this seems to be a principal reason of that universal irritability prevailing there, and of the general sympathy that prevails between every part, particularly as connected with the organs of perspiration.

To keep the skin *in good humour*, cold and tepid bathing, under certain circumstances, is essentially necessary to health. In all diseases depending on a suppressed

perspiration, tepid bathing frequently controls the symptoms, and restores the natural functions on the surface. Evaporation from the surface is more copious from the tepid affusion, and on this the cooling of the body very much depends, particularly when under the influence of febrile heat. The tepid affusion is but little, if at all stimulating; and does not, like the cold, rouse the energies of the system, by which heat is evolved, and the effects of external cold are resisted. Where the object is to diminish heat, that may be obtained with great certainty by the repeated use of the tepid affusion, suffering the surface of the body to be exposed in the interval, to the external air; and if the rays of the sun are excluded, and a stream of wind flows over it, the heat may then be reduced, where cold water cannot be obtained; even in the warmest regions of the earth; on the plains of Bengal or the scorching sands of Arabia.

In the earlier stages of exercise, before profuse perspiration has dissipated the heat, and fatigue debilitated the living prin-

ciple, nothing, we presume, is more safe and healthy than the *cold bath* at a temperature of, from forty-five to sixty-five degrees, of Fahrenheit's scale.

The popular opinion, that it is more safe to go perfectly *cool* into the water, is founded on prejudice; because persons heated, and beginning to perspire, often think it necessary to wait until they are cool, and then plunge themselves into the water: they feel a sudden chilness, that is alarming, and sometimes dangerous: in such cases, the injury is generally imputed to going into the water *too warm*, whereas it arises from going in too *cool*.

TO OUR YOUNG MEDICAL AND MERCANTILE FRIENDS.

Juvenile days are ductile—and susceptible of Intelectual Improvement.

Should your destiny in life lead you to go a long voyage to the eastern continent, or West-Indies, the following is an excellent antiscorbutic and refreshing diet, at sea or land, in hot climates.—It is called *souins*, an acidulous preparation of oat-meal, and deserves much attention. It is prepared by pouring hot water on oat-meal, and suffering it to stand till it has become sourish; decant the liquor, which is to be boiled to the consistence of a jelly, and may be procured on ship board: the macerated oatmeal may be made like mush or sup-on, and eaten with sugar or syrup, for the ship's company.

The diseases of hot climates are generally diseases of exhaustion, caused by the too powerful action of the stimulus of heat, hence the necessity of taking frequently,

cool acidulated drinks, which restore the tone of the fibres by absorbing the heat, and preventing its stimulant action.

Thirst is a state of the system opposed to that of hunger, it is a sensation which indicates a state of exhaustion, deficiency of oxygen; oxygenated remedies therefore are required.—Lemonade.

Vegetable and mineral acids contain vast quantities of oxygen. It is in proportion to the quantity of oxygen in the composition of acids that they allay the sensation of thirst; thus vegetable acids are the best remedies against the effects of narcotic poisons (as opium, &c.) for by their decomposition they restore to the fibre the oxygen which the poison had deprived it of. Vinegar taken in large doses cures the state of exhaustion by a strong dose of opium, and prevents death, which might otherwise ensue. It is a well known fact, that inebriated persons become sober by drinking a glass of vinegar; that is, the vinegar restores the tone of the system, which it had lost by the alcohol contained in the wine:

A great quantity of water produces the same effect.

The bite of a viper, or other venomous reptiles, is said to be cured by frequent washings with a solution of pot-ash; the cure indicated presumes the presence of an acid, and the remedies resorted to are alkalies to decompound an acid, which is admitted through the medium of a wound, produced from the bite of the animal, under the influence of the excess of caloric: in such accidents, fear often destroys the effects of remedies, and prevents a cure, by producing a repulsion of the fluid from the surface to the more noble parts of the circulation.

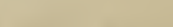
Preservatives against, and cure of yellow fever, or other malignant affections in hot climates, or in our summer months, particularly where a great range of heat in the atmospheric temperature prevails, combined with moisture, depend upon the

means proper for keeping at a distance both within and without the body, an excess of caloric.

"Fly the rank city; shun its turbid air;
Breathe not the chaos of continued smoke,
And volatile corruption, from the dead,
The dying, sick'ning, and the living world
Exhal'd, to sully Heaven's transparent dome
With dim mortality."

We recommend to public patronage, those young physicians of genius, who are brought forward and supported in their profession, by the approbation of those who are judges of their merits. Happy country! where science, aided by the genius of Liberty, unfolds, and is rapidly diffusing her riches through every part of her widely extended territory! May "the wilderness and the solitary places be glad, and the desert rejoice and blossom as the rose."

GLOSSARY.



ATMOSPHERIC AIR contains

72 parts of Azote,	} Gass	{	Mephitic, or contagious air.
27 Oxygen, and		{	Vital air, or Acidifying principle.
1 Carbonic Acid		{	Fixed, or unrespirable air.

AZOTE, Phlogisticated air; a tasteless and inodorous element, which exists in great quantities in the atmosphere: it extinguishes a lighted taper.

An ACID is a combination of vital air, or oxygen, with certain elementary bases; every acid substance possesses a sour taste, changes the colour of syrup of violets, &c. *red*, and mostly effervesces, as with alkalies; they are divided into animal, vegetable, and mineral; of each of which, there are several: in a figurative sense, acids may be said to be the *teeth* of time.

CARBONIC, is pure charcoal or the black residuum of vegetables which have undergone a complete decomposition of their volatile principles by fire. Inflammable air, or possessing all the apparent properties of air, 13 times lighter than atmospheric air.

CALORIC, principle of heat, or heat extricated from what ever cause.

CONTENTS.

CONTENTS.

ERRATA.

Page 68, line 3d. for *tricuspidates*, read tricuspides.
—— 70, do. 7, for *cervicle*, read cervical.
—— do. do. 21, for *radical*, read radial.
—— do. do. 23, for *inter-ossial*, read inter-osseal.
—— 71, do. 12, for *cæliac*, read cœliac.
—— 16, do. 6, for *sphacnoides*, read sphænoides.
—— 38, do. 3, for *chyle*, read chyme.
—— 80, do. 15, for *saines*, read sanies.

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